SEEING THE ENEMY: ARMY AIR FORCE AERIAL RECONNAISSANCE
SUPPORT TO U.S. ARMY OPERATIONS IN THE MEDITERRANEAN
IN WORLD WAR II

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ABSTRACT

SEEING THE ENEMY: ARMY AIR FORCE AERIAL RECONNAISSANCE
SUPPORT TO U.S. ARMY OPERATIONS IN THE MEDITERRANEAN IN WORD
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ACRONYMS

AAF	Army Air Forces
AAC	Army Air Corps
AFHQ	Allied Force Headquarters
ALO	Air Liaison Officer
ASC	Air Support Command
ETO	European Theater of Operations
GLO	Ground Liaison Officer
HQ	Headquarters
MAAF	Mediterranean Allied Air Force
MAPRW	Mediterranean Allied Photographic Reconnaissance Wing
MAPRC	Mediterranean Allied Photographic Reconnaissance Command
MITC	Military Intelligence Training Center
MPIC	Mediterranean Photo Intelligence Center
NAPRW	North African Photographic Reconnaissance Wing or Northwest African Photographic Reconnaissance Wing
NAAF	Northwest African Air Force
PMS	Photo Mapping Squadron
PRG	Photo Reconnaissance Group
PRS	Photo Reconnaissance Squadron
RAF	Royal Air Force
TAC	Tactical Air Command
TRS	Tactical Reconnaissance Squadron
TTP	Tactics, Techniques, and Procedures

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CHAPTER 1

INTRODUCTION

Ground commanders have always sought to use elevation as a way to observe their opponents and detect their disposition and movements. Mountaintops, trees, church steeples, and even balloons have all provided vantage points to gather information on enemy forces. With the advent of aviation in the early 1900s, aircraft offered another level of elevation from which to observe an adversary. In fact, the earliest military applications of aviation centered on observation and reconnaissance.

When the U.S. joined World War I, aerial reconnaissance under the Signal Corps was primitive compared to that employed by European air forces. The U.S. Army partly closed the gap by establishing a photo center in France to learn from French and British experience. Many of the basic techniques later used in World War II developed in World War I. Many of these methods evolved directly from observations made of French and British operations including detection of changes in ground activity using comparative coverage, photos taken from vertical and oblique angles, using adjacent photos to build mosaics or create three-dimensional views, and dividing photo interpretation into phases.[1]

While American aerial reconnaissance made major strides during World War I, when the war ended many of these skills atrophied or disappeared from the U.S. Army Air Corps (AAC) during the 1920s and 1930s. Congress slashed military spending across the services leaving few resources for aerial reconnaissance training and equipment. What funding that did exist centered mostly on mapping the wide expanses of American territory for civil aviation and other commercial and government applications.[2]

As World War II neared, General Werner Von Fritsch, Commander-in-Chief of the German Army High Command, stated, "The military organization with the best aerial photoreconnaissance will win the next war."[3] His statement appeared prophetic given the robust capability the United States possessed in 1945. However, it is not simply a question of who had the best reconnaissance, but how effectively did the Air Corps' and later the U.S. Army Air Force's (AAF) reconnaissance support U.S. Army operations.

Aerial reconnaissance supported the Army in two principle forms. First, the Air Corps provided direct support to ground forces in the form of voice and written reports, and photo prints given to army, corps, and division levels for planning and execution purposes. This thesis will discuss support in the Mediterranean theater, where ground and reconnaissance units remained largely intact in the Mediterranean from November 1942 through May 1945. Therefore, one can trace the evolution in organization, doctrine, tactics, technology, and training as these units gained experience. The British Royal Air Force (RAF) contributed to this effort, but its operations will only be included for those areas that are inseparable from the Air Corps. The Army had organic observation units attached directly to its army, corps, and division artillery units, but these are also beyond the scope of this thesis.[4] Second, aerial reconnaissance indirectly supported the Army by providing photos and reports to strategic and tactical air units that enabled them to interdict enemy supplies and reinforcements. Interdiction often played a major factor in successful ground operations, but this subject will receive only brief mention.[5]

To date, many of the secondary sources covering AAC aerial reconnaissance have focused on support to air operations, especially the targeting and battle damage assessments associated with the strategic bombing campaigns. Consequently, those

sources that have addressed support to ground forces have not covered the subject comprehensively; they have largely described anecdotal stories of support to maneuver units or covered brief periods. The few that have covered the subject in depth have almost exclusively addressed the topic from the Air Corps' perspective, or covered the theme as part of a wider discussion of tactical air force support to ground forces.[6]

By 1945, reconnaissance units in the Mediterranean theater had effectively adapted the necessary operational and tactical employment doctrine and organizational structure to support ground operations. When supported by some of the best technology available and an improved training program, as compared to that before the war, reconnaissance units produced a staggering number of reports and photos in support of Army units in theater. However, understanding this effectiveness is not as simple as examining the number of reports or their intelligence value alone, though that is important. Effective support to ground units required a complex interaction and execution of the Air Corps' organizational structure, doctrine, training, technology, tactics, resources, and environmental factors that permitted the photos and reports to occur in the first place. Aerial reconnaissance required an intricate process to task, collect, interpret, and disseminate intelligence, while learning from mistakes and adapting to ever-changing adversaries and operational factors. Ultimately, it had to satisfy the needs of ground commanders by answering the basic questions that generated the mission, while reaching units in time and sufficient quantity to be effective. Without meeting these criteria, Army users questioned its effectiveness.

Effective aerial reconnaissance in the Mediterranean required several factors to succeed. Liaison officers at multiple levels played a critical role in clarifying collection

requirements and provided an understanding of their unit's capabilities and limitations. Reconnaissance units themselves demonstrated amazing flexibility in adapting to resource shortfalls and overcame the challenges presented by rugged terrain and enemy threats. Finally, Air Corps leaders in theater compromised on one of the core lessons they had learned in North Africa, the need to centralize air assets under an air commander. From 1943 to 1945, Fifth Army had a photo reconnaissance squadron permanently in direct support. This unusual relationship sacrificed a measure of autonomy, and differed from that practiced by most other units in theater and even by reconnaissance units in Europe. It eliminated several layers of beauracracy and undoubtedly contributed to the degree of effectiveness achieved.

In 1945 the degree of satisfaction by ground commanders, especially at corps and division levels, remained mixed. Photo reconnaissance produced poor results in North Africa due to poor management and inexperience, but improved markedly in Sicily. By end of operations in Italy in May 1945, photo reconnaissance played its most important role by providing detailed intelligence in support of operational planning and in covering static battlefronts. Photo prints reached all levels from army to platoon in these situations because reconnaissance squadrons had ample time. However, during mobile operations the Army largely outpaced the ability of reconnaissance units to take pictures and develop them within sufficient timelines to be effective. Photo reconnaissance became less useful during maneuver warfare as even minor enemy movements and Army battlefield advances somewhat negated the detailed location information the photos provided. This problem was magnified at lower echelons where tactical movements could change unit positions frequently, but had less impact at higher echelons that had a

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larger operations area and broader perspective. These units needed more generalized

enemy locations and equipment counts compared to divisions and below. The Air Corps

compensated for the degraded photo reconnaissance by using pilots to visually observe

enemy activity and immediately report events by radio to speed the dissemination of

information. Visual reconnaissance increased speed, but the limited analysis sacrificed

accuracy and detail, and caused intelligence personnel and commanders dilemmas

regarding which one to accept. The complementary nature of these two capabilities in

either situation represented the true success of aerial reconnaissance in this theater.

With this as a basis, this thesis will examine the effectiveness of aerial

reconnaissance in support of U.S. Army operations in the Mediterranean through the lens

of the organizational structure, employment doctrine, training, and technology utilized

and the degree of Army satisfaction. The discussion starts with the pre-war and early war

situation that existed on the eve of operations in North Africa. Reconnaissance units

learned important lessons relative to their early war concepts, and applied those lessons to

operations executed in Sicily. Reconnaissance support continued to evolve after Sicily

and throughout the Italian campaign. While reconnaissance units never satisfied ground

commanders in every situation, they maximized the resources available to employ these

capabilities as effectively as possible.

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[1]Roy M. Stanley, *World War II Photo Intelligence* (New York: Scribner, 1981), 21, 26, 29, 32.

[2]Ibid., 32-37, 56.

[3]3rd Photo Group, *Photo Recon for MATAF and 15th Army Group* (1945), iii.

[4]See Robert Jackson, *Army Wings* (Pen and Sword Aviation, 2006) for more information on the contribution of liaison aircraft in a reconnaissance role.

[5]Two books discuss the Mediterranean air interdiction campaign in detail; John Kreis, ed., *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II* (Washington, DC: Air Force History and Museums Program, 1996); Eduard Mark, *Aerial Interdiction: Air Power and the Land Battle in Three American Wars* (Washington, DC: Center for Air Force History, 1994).

[6]These are some sources that cover aerial reconnaissance support to ground operations over limited periods and for specific units; Robert Boyle, "History of Photo Reconnaissance in North Africa Including My Experiences with the 3rd Photo Group" (Ph.D. diss., University of Texas, 1948); Robert Futrell, *Command of Observation Aviation: A Study in Control of Tactical Airpower* (Maxwell AFB: Air University, 1956); Tom Ivie, *Patton's Eyes in the Sky: USAAF Combat Reconnaissance Missions - North-West Europe 1944-1945* (Hersham: Classic Publications, 2003); David Spires, *Patton's Air Force: Forging a Legendary Air-Ground Team* (Washington, DC: Smithsonian Institute Press, 2002).

CHAPTER 2

FOUNDATION: SETTING THE STAGE

Overview

To understand the employment of aerial reconnaissance in the Mediterranean, one must comprehend the state of doctrine, organization, principles of employment, training, and technology on the eve of the invasion of North Africa. Resource shortages and differences between the Army and Air Corps over the basic purpose, aircraft type utilized, and control plagued the development of reconnaissance units. Consequently, aerial reconnaissance units were unprepared for operations in North Africa and major changes had to be taken to correct the deficiencies.

Doctrine

Organization

Pre-war and early World War II aerial reconnaissance included two types: observation and photo reconnaissance. Observation became synonymous with support to ground units and artillery adjustment through visual means only, but later included photographic capabilities. Photo reconnaissance strictly involved aerial cameras and supported both the Army and the Air Corps. Command and control of these elements faced many changes before their employment in North Africa and its evolution directly related to the types of aircraft selected. More than any other component of the tactical air forces, essentially non-strategic bombardment aircraft, none more closely aligned with the mission of ground forces than observation units.

Before America's entry in the war, Army ground forces had their own assigned observation units.[1] Doctrine of the 1920s and 1930s reflected this with statements like "observation aviation is an auxiliary arm" and "it is included as an integral part of armies, corps, and divisions."[2] By 1936, a corps was authorized four observation squadrons, one for each of the three divisions, and one for itself.[3] When the Army reorganized in the late 1930s, the corps became the primary ground maneuver element. As such, army and corps level units retained observation squadrons by 1939, though National Guard divisions maintained their own squadrons. Much like the rest of the pre-war American forces, this organization of observation assets remained notional since the AAC lacked the resources to either fill the active or guard requirements.[4]

Despite limitations in material and manpower, reconnaissance doctrine and organization did not develop in a vacuum. The Air Corps tracked developments in other countries, notably Britain. RAF observation pilots realized the difficulty of conducting reconnaissance in light observation aircraft against fast German fighters during the 1940 Battle of France. When Air Corps officers inquired in 1940 on the feasibility of the British Lysander light aircraft, the Royal Air Force responded that tactical reconnaissance aircraft needed greater speed and armament. Lieutenant Colonel George Kenney, an American air leader who later gained fame as General Douglas MacArthur's air commander in the Pacific, concluded that "pilots, both French and British, are unanimous in the opinion that such [light] airplanes cannot live at the front or even near the front as long as the hostile pursuit has freedom of air action."[5]

In spite of these observations, the Air Corps' leadership seemingly continued along much the same path. Part of this inaction resulted from an interwar focus on photo

reconnaissance for cartography, which ordinarily occurred in a permissive environment. An Army multi-branch study in the fall of 1940 identified the need for only two types of aircraft: a longer range, twin-engine aircraft for deep reconnaissance missions to satisfy tactical and strategic observation and photographic requirements and a short-range light aircraft for corps and division observation support. The former became the A-20 attack plane (see figure 1), and though many aviators realized the slow speed of light aircraft, the Field Artillery branch persisted in pursuing these because they could operate as aerial spotters from austere airfields near the frontline. Ground exercises in the summer of 1941 reinforced this belief and the Air Corps eventually conceded light aircraft could function over friendly territory, which effectively . The disagreement between the Air Corps and Army over the type and role for these light aircraft continued and resulted in their re-designation from "O" for observation to "L" for liaison in April 1942 to clarify their purpose. This struggle represented a difference over basic requirements and how best to satisfy that need, especially the artillery's need for aircraft based near the front that quickly moved with the army. Of note, the 1940 study recognized that armies must concern themselves with deeper zones than the fifty miles identified in pre-1939 doctrine; thus once again stressing the need for something other than light aircraft.[6]

Meanwhile, Air Corps officers continued their efforts to develop reconnaissance units based on fast, twin-engine aircraft. While a War Department training circular from June 1941 admitted light aircraft could operate in a permissive environment with air superiority, the Air Corps expected enemy threats would force a dependence on aircraft flying at high altitudes at maximum speed, thus requiring a greater emphasis on photography rather than visual observation, and brief sorties into enemy territory. Some

ground commanders seemed reluctant to recognize this point, but Lieutenant General

Leslie McNair, the U.S. Army General Headquarters commander, identified problems in

air reconnaissance doctrine while observing the summer exercises in 1941. Concluding

that participants underutilized photography and that the long loiter over enemy territory

during the maneuvers falsely assumed air superiority, McNair believed aerial

reconnaissance showed promise, but not as employed at the time.[7]

Figure 1.   A-20 Light Attack Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force,"
http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

By early 1941, doctrine writers increasingly realized a need to reorganize

observation aviation to prepare for the coming war. Added to this was another crucial

lesson gained from British experience, the need to centralize control of tactical airpower

under airmen, not ground commanders.[8] Both points presented a difficult task given that

doctrine in 1940 held that "highly centralized control of all observation is undesirable."[9]

Ground commanders wanted control of assigned reconnaissance units, and centralized

command and control represented a direct threat. While centralization affected all airpower employment, it did point to an obstacle in developing reconnaissance doctrine.

When the War Department created observation groups in 1941, it initially assigned them to an air support command, but attached them to field armies or corps. This decision allowed the former to develop the training, equipping, and doctrine, while the ground forces provided the tactical direction during combat. It also marked a gradual effort to centralize reconnaissance assets.[10] Training maneuvers began to demonstrate a need for pooling assets under a single air command and the issue even found inclusion in Field Manual 31-35, *Aviation in Support of Ground Forces, 1942* under the term "higher echelons."[11] A June 1942 training circular similarly reflected, "In order to attain the maximum flexibility . . . [the] air support commander retains centralized control of all observation so assigned."[12] Two months later, the Carolina training maneuvers tested centralization of observation at the corps level. Though sound in principal, the effort failed due to communication problems.[13] The focus on organic versus attached observation support related to McNair's comment that division commanders sought organic assets "as primarily an expression of the invariable tendency on the part of unit commanders to make themselves self-sufficient."[14] The organizational evolution continued with a series of War Department and Air Corps decisions that created three unit types: liaison units organic to the artillery and resourced by the Air Corps, observation units attached to ground forces, and photographic units.[15]

The evolution of air reconnaissance organizations mirrored the gradual transition in doctrine. Doctrine represents experience and forethought, and while never perfect nor always followed in detail, it does provide a glimpse of how the Army and Air Corps

viewed the contribution of aerial reconnaissance, its limitations, and basic tactics in support of ground forces. In spite of resource shortfalls, the Army clearly understood its importance. As indicated in Field Manual 30-21, *Military Intelligence - Role of Aerial Photography, 1940*, "aerial photographs are one of the most important sources of information available to the commander . . . they are of paramount importance to all intelligence sections."[16] The Army held a similar regard for observation to the extent that Field Manual 30-10, *Observation, 1940*, requested "all Air Corps personnel who have been over the enemy's line must be trained to report their observations."[17] Before the North Africa invasion in November 1942, nine basic field manuals discussed air reconnaissance.[18] Individual soldiers clearly had many documents to reference on the subject. Some of the manuals furnished unique or detailed procedures relating to specific Army or AAC operations and requirements, but they contained a surprising degree of overlap. As a whole, these manuals provide visual observation and photo reconnaissance employment tactics, techniques and procedures (TTPs) in the following areas: basic principles, tasking, collection, interpretation, dissemination, and application.

Basic Principles

Of the available doctrine, Field Manual 1-20, *Tactics and Technique of Air Reconnaissance and Observation, 1942;* Field Manual 1-35, *Aerial Photography, 1941*; Field Manuals 30-10, *Observation,* 1940, and Field Manual 30-21, *Military Intelligence - Role of Aerial Photography, 1940*, provided the basics of observation and photographic reconnaissance that units and soldiers needed to employ this capability. These four manuals served as the best of nine primary manuals available, but each covered topics in

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varying degrees of detail and lacked a common organizational thread. Therefore, soldiers would have had a difficult time finding information on similar subjects.

Field Manual 1-20 described the four basic missions that occurred throughout the war: visual and photographic reconnaissance, artillery adjustment, and liaison. Its authors acknowledged that missions would entail not only deep penetration for strategic targets, but also coverage of large areas close to the battlefront to secure information of the enemy rear and flanks. The manual fundamentally misunderstood the aircraft types best suited to perform these missions in the contemporary threat environment. It assumed that high performance fighters would satisfy the deep penetration missions while light, low performance aircraft would handle missions along the battlefront.[19] Events in North Africa forced a reassessment of that concept due to heavy losses among light aircraft.

This manual also described support to different ground echelons of the field army, the corps and division. The two biggest differences between these levels concerned the scope of area covered and the degree of detail. While support to a field army and corps required the broadest coverage and description of enemy activity in general terms, divisions needed a continuous supply of as much information as aerial reconnaissance could provide, to include individual firing positions and points of resistance. Ideally, according to Field Manual 1-20, *Tactics and Technique of Air Reconnaissance and Observation*, reconnaissance units should remain physically close to the supported unit headquarters, be included within the communications networks, and have the capability to relocate quickly in support of rapid advances by mobile forces.[20] Ground commanders believed that too much separation between ground and air command headquarters would create communication and coordination problems. This represented a differing

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philosophy that existed throughout the war on the degree of centralization needed to allow airmen the flexibility to meet the demands of many units across a wide area versus the decentralization required to effectively support individual ground commanders.

In addition to the various echelons, Field Manual 1-20 described variations in support required by artillery, infantry, cavalry, and armor units. Artillery needed accurate target identification, registration and adjustment of artillery fire, with a focus on long-range artillery fire against defiladed positions. Once again, the Army focused on multi-seat light aircraft, "The use of single-seater observation airplanes for artillery missions is limited. Pilots are not ordinarily trained in the principles of adjustment of artillery fire. Moreover, the pilot's concern with the handling of the airplane will interfere with an alternate role as observer."[21] The distinctions between infantry, cavalry, and armor reflected thinking similar to the armies and divisions; mobile units needed area coverage like armies to identify routes and major hostile units, but also sufficient detail to identify weak points to attack. Only in support of armor forces did a realization exist that light aircraft might not suffice, "The rapidity of armored force operations may frequently require that combat aircraft perform the dual role of reconnaissance and attack during a single flight in order to insure timely support in fast moving situations."[22]

For the layman, Field Manual 1-35, *Aerial Photography, 1941*, provided an overview of aerial photography basics including terminology and photographic products. Aerial photographs came in three basic types: vertical, oblique, or composites of both. The first maintained a horizontal focal plane that paralleled the earth's surface and essentially looked straight down on a target. Verticals photos provided a wealth of detail of areas otherwise inaccessible, and maintained uniform scale throughout the image with

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minimal distortion on the picture edges, but compared to maps or oblique photos, terrain relief became difficult to discern in these. In contrast, oblique photos intentionally tilted the focal plan to look at the Earth's surface from an angle. While the physical photo print size remained the same as a vertical, typically nine by nine inches, the area covered by the picture represented a trapezoid. Obliques came in two types: low obliques that did not include the horizon in the photo and high obliques that did. (see figure 2) Whether high or low, this technique offered a hilltop perspective and thus represented terrain relief better than a vertical, but that view came at the expense of non-uniform scale throughout the photo. While photo reconnaissance generally depended on vertical photographs to acquire detail, obliques helped mitigate threats and weather by using angled cameras to standoff from a threat or image from beneath a cloud deck. From its angled perspective, interpreters found obliques useful for distinguishing man-made objects from terrain that might not otherwise be seen in verticals. Despite this advantage, enemy activity could easily "hide" behind vegetation and ridgelines obstructing line of sight.[23]

Field Manuals 1-20 and 1-35 also explained several other basic concepts including stereo images, night photography, strips, and mosaics. Stereo images resulted from taking two photos of the same point with 60 percent overlap between the images and viewing them through a stereoscope. (see figures 3 and 4) Interpreters could view targets as large as airfields or railroad marshaling yards as stereo pairs. These images produced greater detail than a standard vertical photo, providing a three-dimensional effect that permitted interpreters to measure object height and better detect camouflage. Another key capability was night photography, which offered an ability to deny adversaries the cover of darkness. The technical capabilities of the period limited night

photography to small targets such as major road junctions, marshalling yards, or other

targets pilots could find at night with poor illumination and navigation systems.[24] Strips

resulted from a series of overlapping vertical or oblique images of roughly the same scale

laid side by side. (see figure 5) Pilots achieved this by photographing a string of photos

along the aircraft's line of flight. Mosaics simply combined two or more overlapping

strips from multiple flight lines. Personnel combined strips and mosaics using glue, tape,

or fasteners to build composite photos covering hundreds of square miles. Mosaics

proved valuable when examining frontlines, coastlines, and broad area coverage. Mosaic

and strip production involved a complex process to ensure the photos had the same scale

throughout each photo, to reduce the effects of tilt between images taken at different

angles, to match variations in black and white tones, and to remove distortions. Once

personnel addressed these items, they matched adjacent photos to build the mosaic.[25]
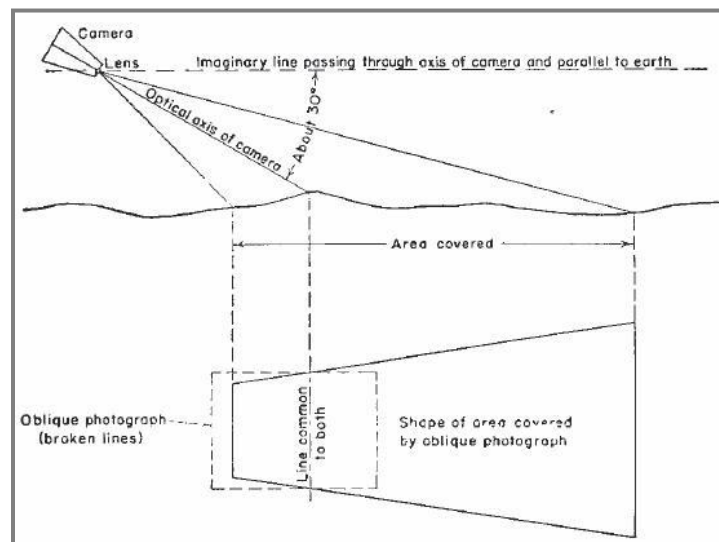
Figure 2.   Oblique Photograph Ground Area Coverage.
Source: War Department, Army Field Manual 21-25 (Washington, DC: Government
Printing Office, 1941), 72.
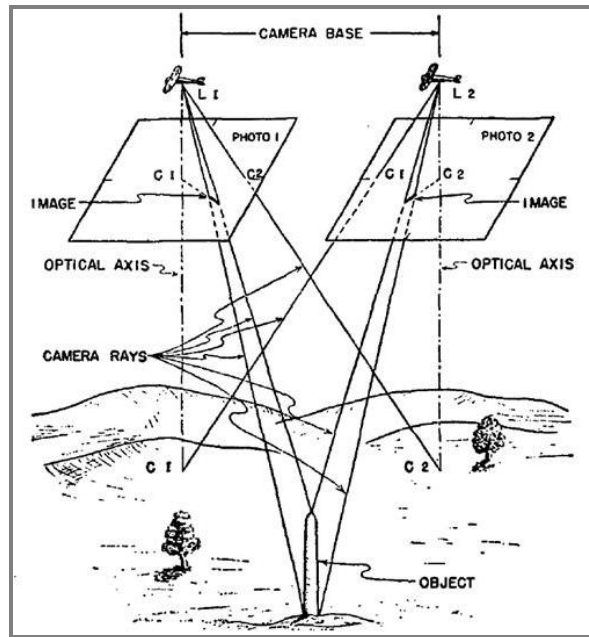
Figure 3.   Collecting Stereoscopic Pairs
Source: War Department, Air Corps Field Manual 1-35 (Washington, DC: Government Printing Office, 1941), 12.

Figure 4.   Perception of Stereo Pair to Photo Interpreter
Source: War Department, Air Corps Field Manual 1-35 (Washington, DC: Government Printing Office, 1941), 13.
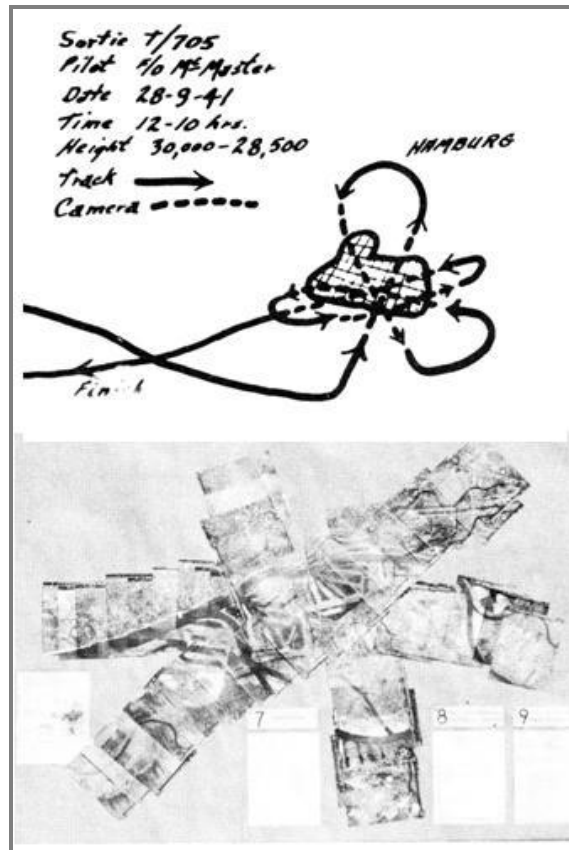
Figure 5.   Flight Path and Resulting Photo Strips From RAF Mission Over Hamburg
Source: Strategic Reconnaissance, Army Air Forces School of Applied Tactics, *Air Force Photography: The Role of Photographic Aviation* (Orlando: Army Air Forces School of Applied Tactics, 1943), 29-30.

Tasking

Aerial reconnaissance required a timely process to identify, prioritize, and task intelligence requirements for execution. Without it, aerial reconnaissance products were of little value to ground commanders. Tasking involved the procedures to convey collection requirements, known then as demands or requests, and the selection of visual or photographic means to satisfy the request. Unit liaisons, as identified in Field Manual 30-5, *Combat Intelligence, 1940*, played an essential part of the process. Ground forces

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with attached reconnaissance units established liaisons within the squadron to keep it appraised of the enemy situation, explain the tasking requirements, and assist in disseminating information back to ground units.[26]

The Air Corps manual *Aerial Photography*, provided principal ownership over requirement identification to the supported unit. Army manual *Military Intelligence - Role of Aerial Photography* assigned that responsibility to unit commanders with support from the assistant chief of staff G-2 for the organization, the senior intelligence officer at the army, corps, or division.[27] Notably absent in the doctrine is any discussion of the validation process between the air and ground units, the resolution of disagreements, or prioritization of requirements between the Army, Air Corps and Navy.

Army units built and consolidated requests for their attached reconnaissance assets or submitted the requirements to the next echelon for collection. Both visual and photo reconnaissance often covered areas that ground forces could not observe. Though general area searches sometimes succeeded, the chances of finding enemy activity increased when directed to a specific area with intelligence requirements or to validate information from other sources. To give the needed detail, requests had the following:

1. Map area or point to photograph

2. Approximate hour of exposure

3. Direction and elevation to take oblique photographs from

4. Scale for vertical photographs

5. Purpose for reconnaissance

6. Number of prints needed and the time and place of delivery[28]

To record this information for tracking, published doctrine used matrices that captured many of the same details used by the Air Force today. (see figure 6) Ground commanders established lists of the essential elements of information (EEI); identifying the critical information needed to make sound decisions. This list focused on items such as the strength, composition, location, and movement of forces and reserves, as well as elements of terrain and obstacles.[29] In column three of figure 6, the G-2 identified the specific questions to satisfy the EEI. Users also identified specific constraints such as shadow limitations, degree of overlap, direction of travel, and the time frame in which that information would be of value. Once formulated, G-2s assigned priorities to the tasks and disseminated them to collection agencies through field orders and fragmentary orders. Collection plans became important for validating new requirements against existing or previous ones to prevent redundant collection if coverage already existed.[30]

| INTELLIGENCE PLAN FOR COLLECTION OF INFORMATION					
1	2	3	4	5	6
Phases or periods of the operation or objective folder number and title	Essential elements of information	Analysis of essential elements of information	Collecting agency or other source	Specific orders or requests	Time and method of reporting information. Remarks

Figure 6.   Intelligence Collection Plan
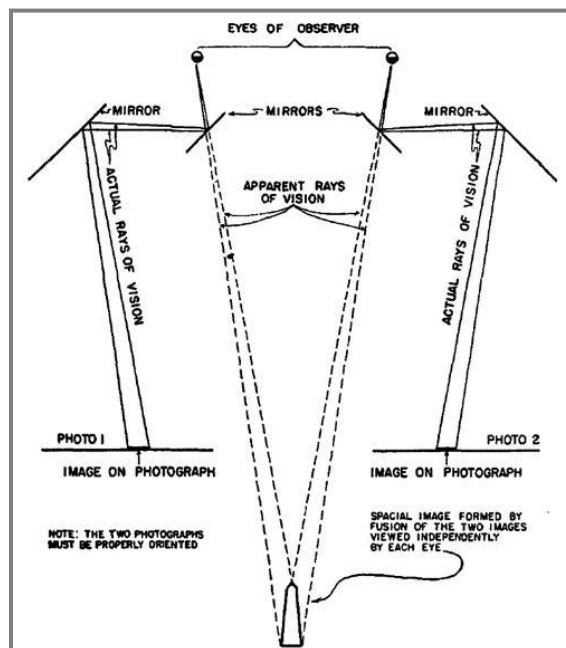*Source:* War Department, Air Corps Field Manual 1-40 (Washington, DC: Government Printing Office, 1940), 15.

Once approved by the ground unit, the intelligence request was matched to visual or photo reconnaissance, or both. Observation offered a quick description of enemy

activity in general terms that pilots reported via radio or immediately after the plane

landed. However, this capability proved challenging since pilots had to identify enemy

activity at high speed while dealing with terrain and enemy threats, or run the greater risk

of being shot down if flying at slow speed to obtain more detail. Even well trained

observers could only hope to capture portions of the ground activity, and often only in

general terms. The observer's freedom of maneuver offered the advantage of many

different perspectives, which likely increased the chance of detection. The field manual

cautioned units against using observation reports without evaluation since an indication

of no activity could simply mean the observer missed static or camouflaged objects.[31]

On the other hand, aerial photos captured terrain and activity for later study and

thus offered a more complete and accurate picture. Photo intelligence could cover small

pinpoint targets or larger areas for general familiarization or map-making. This detail

had a price: timeliness. Early in the war, film development and print production required

two hours for fifteen negatives with five prints each, and up to twenty-four hours for

2,000 to 5,000 prints depending on the production capacity. This time did not include

that needed for photo interpreters to examine the prints for enemy activity. Therefore,

effective aerial photography required planning and clearly stated requirements.[32]

A key aspect of photo reconnaissance involved image scale. Army doctrine

identified the principal difference between small, medium, and large-scale photographs

and their uses. Small-scale photos (1:15,000 and smaller) covered large areas and

provided little detail. These images provided a general understanding of terrain and areas

of interest such as rivers, ridges, valleys, population centers, military installations, and

lines of communication, but very little on enemy activity. Medium scale images

(1:10,000 to 1:15,000) provided enough detail to locate enemy forces and support

artillery counter-battery operations. With these photos, one could discern trench details

and other field works, vehicle columns on roads, and battery positions. Large-scale

photos (1:5,000 to 1:10,000) showed details including real versus dummy gun positions,

camouflaged equipment, vehicle types, tank minefields, observation posts, machine gun

emplacements, road barriers, and barbed wire entanglements.[33] Detail came at a price

since large-scale images covered smaller targets and could not efficiently cover large

areas without overly taxing aviation and intelligence resources. Figure 7 shows a

comparison of the overall coverage as dotted lines for different focal length cameras.

Therefore, units continually had to balance between the area coverage and detail needed.
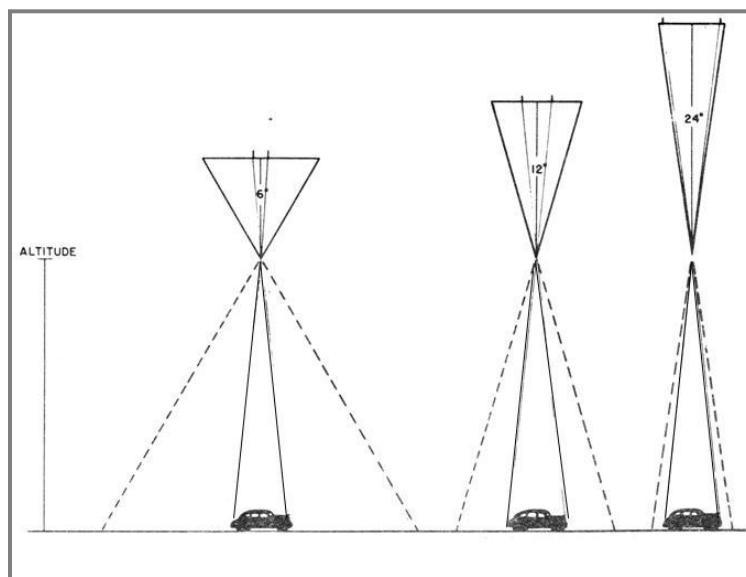
Figure 7.   Relationship Between Area Coverage and Focal Length
Source: Strategic Reconnaissance, Army Air Forces School of Applied Tactics, *Air Force Photography: The Role of Photographic Aviation* (Orlando, FL: Army Air Forces School of Applied Tactics, 1943), 19.

Collection

Collection encompassed the process of mission planning, pilot briefing, and execution to secure the needed information. While observation missions certainly entailed mission planning, photographic missions required much greater detail. *Aerial Photography* frequently emphasized that once photo reconnaissance had been selected, the squadron would decide the best method to secure the intelligence. Upon receiving the request, a delicate balancing act commenced between operational equipment, the threat, environmental factors, and the requirement.

A driving factor in the collection involved scale and the area to cover. The following equation shows the photo scale relationship: Scale = camera focal length (feet) / altitude (feet). (see figure 8) From this, a twelve-inch camera at 20,000 feet produced a 1:20,000 scale image, while a six-inch camera at the same altitude produced a 1:40,000 scale photo. In order for the smaller focal length camera to achieve a 1:20,000 scale, the pilot had to fly at 10,000 feet. By comparison, the German 88-mm. anti-aircraft artillery piece, the most common large caliber type, had a maximum effective altitude of 26,000 feet.[34] The relationship between scale and focal length also drove the number of parallel flight lines needed to cover an area. Therefore, aircrews could not simply use a smaller focal length at a lower altitude to optimize coverage and detail. Doing so exposed pilots to a greater ground threats as well as terrain features.

Beyond optimizing camera selection based on technical capabilities, air planners also had to account for environmental factors and enemy detection and threats. First, reconnaissance missions had to see the target. Weather, haze, and terrain could easily inhibit a mission. Seasonal variations presented their own challenges with thick forests in

the summer that became less dense in fall and winter, while streams and grassy fields also varied with rain and seasons. Snows in Italy proved particularly challenging by hiding equipment and tracks from aerial observation. Effective daytime missions required not just daylight, but enough sunlight to expose the film properly. This usually existed in most areas between 10:00 am and 2:00 pm when greater light produced sharper details.[35] Though night photography existed, moon illumination limited it to covering small, easily recognizable fixed targets and necessitated excellent navigation to the target.
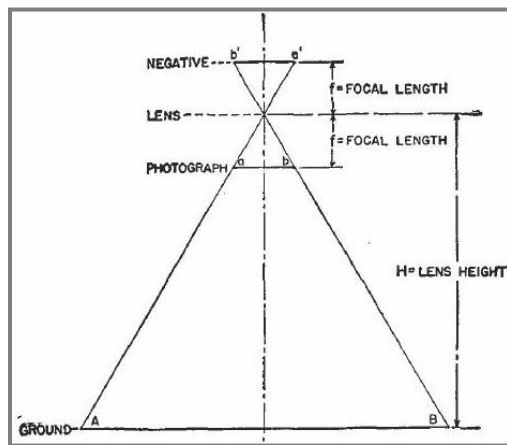
Figure 8.   Photograph Scale Depiction
Source: War Department, Army Field Manual 21-25 (Washington, DC: Government Printing Office, 1941), 90.

Terrain played a major role from several perspectives. Adversaries used it to conceal or defilade its positions from observation. The deserts and rocky terrain of North Africa contrasted sharply the heavily forested areas of France, Germany, and Italy that reconnaissance units later encountered. As such, rugged terrain required vertical or near vertical coverage maintain line of sight, while oblique photos revealed the terrain's

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ruggedness. Terrain limited avenues of approach, especially when combined with enemy threats. Pilots needed an intimate understanding of the terrain over which they would operate. Too much time looking at a map when flying meant less time performing visual reconnaissance or avoiding threats and terrain.[36]

Security became paramount, reducing the enemy's ability to interfere with reconnaissance missions. Daylight favored reconnaissance and observation, but it also favored detection and interception. Reconnaissance missions faced a combined threat from aircraft and anti-aircraft artillery that posed a significant obstacle since the mission was not complete until it returned to base. The field manuals required reconnaissance units to maintain maps of the ground situation to understand allied and adversary ground activity. Since photographic missions flew as single aircraft into enemy territory, doctrine recommended planning these at the highest practical altitude depending on weather to avoid drawing attention. The longer twenty-four and thirty-six inch focal lengths aided this process by providing large-scale images from even 25,000 to 30,000 feet. Pilots could approach a target at maximum altitude, and then descend to the operating altitude during photo collection. Other methods to delay or avoid detection included using darkness to ingress or egress a target area for deeper missions, flying in and out of unfavorable weather to accomplish the same or to cover multiple passes of target areas, and approaching targets from the sun to complicate visual detection.[37]

Air reconnaissance doctrine identified several other key planning factors. Pilots should maintain secondary targets in case of weather or threat activity prevent coverage of primary areas. Based on the threat and target importance, units could independently send more than one aircraft against the same target to increase chances of success.

Likewise, the use of escorts or concurrent air operations by other aircraft might divert enemy attention to other aircraft. Reconnaissance unit commanders could maintain a reserve and refrain from exhausting their units, while also maintaining close liaison with supported units to anticipate developing situations. Mapping missions required large area coverage from as high an altitude as weather permitted, and with long straight flight lines in parallel succession. These predictable flight paths greatly increased aircrew vulnerability to enemy threats. Given the requirement for clear weather and the time needed to produce maps, ground units needed to request mapping photography in advance of its actual need.[38] Interestingly, the manuals do not mention how reconnaissance missions would deconflict their flight paths with other aircraft flying combat missions. This likely explains some of the "friendly intercepts" of reconnaissance aircraft during missions throughout the war.

Once units matched the camera type to the requirement, pilots received a pre-mission briefing of all the details from the squadron's intelligence personnel. Although not available until late 1942, "Photo Intelligence for Combat Aviation" offered many of the basic mission briefing concepts for these units:

1. Detailed description of objectives to be covered, objective priorities, and maps previous photo coverage showing reference points and landmarks

2. Camera types carried on aircraft and type of coverage (pin point, area, strip, vertical or oblique)

3. Weather conditions enroute and at target, altitude needed, and desired flight line and time of day (related to available sunlight and shadow effects)

4. All known dangers

5. Communications and routes to objective areas

While the briefs seemed prescriptive, pilots had the flexibility to alter the mission as operational factors such as threats and weather dictated.[39] This became particularly useful since the P-38 (known as the F-4 or F-5) carried both vertical and oblique cameras. (see figure 9)

Figure 9.   P-38 Lightning Fighter or F-4 / F-5 Photo Reconnaissance Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force," http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

With pilots and aircraft prepared, units executed their collection. Robert Futrell, an airpower historian, concluded observation employment doctrine in 1939 had not progressed much beyond that developed in WWI. Units stayed within forty to eighty miles of the front lines to reduce transit times. Essentially, the aerial observer covered the front, flanks, and rear of enemy forces to a depth of ten to twelve miles for a corps, and twenty-five to fifty miles for an army. Formations might include as many as three to five aircraft and with information communicated via radio only when immediately necessary, otherwise observation crews reported results with message drops to ground units. Pilots determined the altitude based on the factors described above. Since these

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missions flew at lower altitudes and close to enemy lines, serious threats might force some to observe from the safety of friendly lines, or vary altitude, speed, and axis when making repeated passes of the same area.[40] Ten years removed from observation aviation, Colonel Robert Goolrick commented in February 1941, "I find, after all these years, practically no change in the basic theories of the branch and very little change in the equipment assigned. This important branch of the Air Corps has stagnated for the past fifteen years."[41] This conclusion did not bode well for operations in North Africa.

For photo reconnaissance missions, *Aviation in support of Ground Forces* recognized the aviator's critical role and devoted an entire section to "pilotage." Armed with a detailed understanding of the tasking and camera capabilities, pilots could flexibly employ their aircraft as needed. Still, flexible employment did not mean a complete lack of procedures. Effective target coverage required precise navigation and level flight. Failure to do so risked missing the target altogether or affected the overlap of each successive exposure for purposes of strips, mosaics and stereo images. If pilots discovered an error in flight, they needed to make minor corrections since abrupt changes could cause significant image distortion. Once at the target, low altitude missions had a shorter decision cycle and less room for error. Moreover, a second pass of the same target would surely face alerted defenses. Finally, pilots needed to check the mission results to improve their understanding of the tactics they executed, the technical capabilities of the equipment, and their impact on the final product. All of these helped improve their skill, as they better understood the requirement and final product.[42]

Interpretation

Interpretation included the methods visual observers and photo interpreters

utilized to extract information needed to solve the collection requirement. Once in the

area or looking at a photo, pilots and interpreters used many indicators to draw their

attention toward potential activity, much of which centered on an adversary's impact on

the environment or movement in the case of visual observation. As Colonel Roy Stanley

noted after the war, "Everything man does on the face of the earth leaves a trace."[43] Even

then, the speed of aircraft could cause observation pilots to miss significant details.

Photographs helped fill that void by fixing the ground activity for analysis.

For observers, *Tactics and Technique of Air Reconnaissance and Observation*

stressed the need for accuracy when reporting. At a minimum, they needed to identify

the what, where, and when of activity. Details sought included an estimate of strength,

composition of forces, disposition and location of defensive positions, direction of travel

and rate of movement, and obstructions. Observers expedited information delivery to

ground units via radio when needed, and used short transmissions to complicate enemy

location and tracking.[44]

Photo interpretation, on the other hand, assumed a more methodical nature given

the additional detail and time available. Once presented with a photo, interpreters

utilized a multitude of techniques to identify enemy activity. They first oriented the

photo with a map, plotted the area covered, and analyzed the terrain. From there, the

easiest method of identifying objects involved looking for straight lines since ordinarily

these do not exist in nature. They also utilized shapes, relative size, shadows, and

differences in shades of gray and textures between objects. Often, interpreters located

activity not from the objects themselves, but their impact on the environment such as trampled vegetation, track marks through wet soil or snow, spoil piles from trenches and foxholes, dust raised from moving units, as well as lights, fires, and gunfire during low light photography. These telltale signatures became more obvious when comparing old and new photos, known as comparative coverage, and helped track construction and camouflage activity. Another useful tactic involved using tip offs from other intelligence sources as a cue on what and where to look.[45] Table 1 shows a comparison of the actual size of various objects and their relative size at different scales. For some objects, such as a foxhole, interpreters would have had a problem even seeing it on smaller scale photos, let alone identifying it.

Table 1. Comparison of Objects at Different Scales on a Photo					
Object	True Length	1:5,000	1:10,000	1:20,000	1:40,000
Foxhole	6 feet	0.0144 inches	0.0072 inches	0.0036 inches	0.0018 inches
SdKfz 124 "Wespe" (105 mm SP Artillery)	16 feet	0.0384 inches	0.0192 inches	0.0096 inches	0.0048 inches
Tiger I Tank	28 feet	0.0672 inches	0.0336 inches	0.0168 inches	0.0084 inches

Source: David Doyle, *Standard Catalog of German Military Vehicles* (Iola, WI: KP Books, 2005), 90, 168.

In principle, adversaries used camouflage to disguise items of importance, which presented a unique challenge. Effective camouflage had to be complete, naturally blend with the environment, and units had to employ it religiously. An adversary could not simply hide their equipment, such as an artillery piece, they also had to disguise the tracks and routes leading to it. In contrast, dummies and decoys became noticeable due

to the lack of nearby vehicle and foot traffic. Any minor breach such as poorly disguised bivouacs, kitchens, and trails could draw attention to the entire area, and easily nullify effective camouflage of combat equipment.[46] Even then, "camouflage invisible to the eye is occasionally visible to the camera, and vice versa."[47] Photo interpreters made their money looking for these signatures. German units regularly relied on camouflage netting to enhance natural terrain features and hide positions and equipment, yet interpreters viewing photos in stereo could "look through" most netting. Careless concealment in rear areas divulged supply dumps and command posts, while front-line units had the added complexity of hiding themselves against ground and aerial observation. Given the enemy's relatively smaller groups of men and equipment at the front, this eased their task slightly along with the availability of materials from the surrounding environment. Despite these signs, the manuals cautioned interpreters against jumping to conclusions and encouraged them to base their assessments on sufficient evidence.[48]

As with other reconnaissance developments, the British once again extended their influence into photo interpretation. Doctrinally, *Role of Aerial Photography* made provisions for photo interpreters located at division and higher organizations. In contrast, the British gradually centralized their interpretation resources for greater efficiency, a situation the U.S. later mirrored. The British divided exploitation into three phases. The first involved a quick look at a photo to get information out as quickly as possible, usually within hours, and provided little more than an order of battle count of the numbers and types of equipment. The second phase involved a detailed look at the same photo for more than equipment counts and provided results within twenty-four hours. Finally, third phase reports involved systematic reviews of target over extended periods.

Proven successful by the British, the U.S. Army incorporated these techniques into its own doctrine and training by 1942.[49]

Dissemination

Air observers inherently understood the difficulty of obtaining information on enemy forces and the need to expedite the delivery of intelligence. Moreover, as ground forces on both sides increased mobility and speed, they reduced the time when information was useable and threatened to outpace collection capabilities altogether. Though susceptible to radio interception by an enemy, visual observers relayed urgent information while airborne via radio to the appropriate ground echelon, usually the army, corps, or division headquarters for further dissemination to front-line units. Upon returning to base, pilots and observers completed a mission debrief with the squadron's intelligence personnel to capture key aspects of the mission for dissemination and future reference; a concept loosely similar to today's nine-line reporting format used as a standardized method to pass information.[50] (see figure 10)

Photo reconnaissance units also recognized the urgency in the dissemination of vital intelligence. Pilots started the process by completing a trace called a pilot's sketch that showed the aircraft's flight path over the ground and general area of coverage for each mission. This served as a basis for a pilot debrief. Liaison officers served an essential purpose by ensuring the pilot's sketch, debrief, interpretation reports, and photo prints reached the requesting units in a timely manner. This information not only completed the tasking cycle, but also provided Army G-2s the details needed to keep indices of photographed areas.[51] Ground units subsequently had this information available both for comparative coverage purposes and as a check of existing coverage

before validating new collection requirements. In a day before modern computers and

digital means, this was a daunting, labor-intensive task.

Figure 10. Pilot and Observer Report for Observation Missions
Source: War Department, Air Corps Field Manual 1-40 (Washington, DC: Government
Printing Office, 1940), 63-64.

Application

Several field manuals provide extensive detail on the application of visual

observation and photo reconnaissance missions. Visual reconnaissance largely focused

on searches for enemy movements along the rear and flanks, as well as support for

artillery fire adjustment. In contrast, aerial photography supported two essential missions

for ground forces: mapping and military intelligence. For the former, aerial photos

provided the basis for constructing maps, or viable supplements, and terrain models.[52] For the latter, they supported a wide range of missions and disciplines.

Prior to an attack, aerial photos provided a wealth of information for planning operations. For example, large and medium scale vertical photos revealed the following about enemy activity: camouflage efforts, supply dumps, observation posts, defensive positions and fields of fire, artillery batteries, equipment, trenches, barbed wire, obstacles, dummy versus real equipment, reserve locations, the effects of artillery and aircraft bombardment, lines of communication, and movement at night. Such information quickly enabled targeting by artillery or aircraft, or became tactical objectives. Moreover, photos supplied information on enemy intent. The forward positioning of equipment and forces indicated a possible impending attack, while obstacles and trenches suggested defensive preparations. The *Role of Aerial Photography* stressed the utility of fusing aerial photos with other intelligence sources, such as prisoner interrogations and captured documents, to provide added corroboration. In addition to intelligence on enemy disposition, photos served to define the environment challenges units would face. Engineers used photos of rivers and roads to determine suitable points for river crossings, the amount of bridging assets required, materials needed for repairs, road traffic loads, and potential bottlenecks. Pictures helped determine beaches suitable for amphibious assault, detailing obstructions, beach exits, wave heights, and natural defensive positions.[53]

<u>Aerial Reconnaissance Training</u>

Air Corps doctrine emphasized the need for specialized photo reconnaissance crew training, but the ongoing doctrine and organization struggles, and competing

priorities caused training to suffer. As units stood up, Air Corps leaders continued to emphasize multi-engine reconnaissance aircraft supporting bombardment type units. For example, the 1st Photographic Group, later the 1st Mapping Group, stood up on 10 June 1941 to perform photo mapping and long-range photo reconnaissance. Its four squadrons were attached to bombardment groups and used the same heavy or medium bombers as their associated units. The unit's training focused on sea-searches in support of bombers conducting continental defense against naval threats. As resource shortages continued and the need for combat units grew, their secondary mission of bombardment replaced the reconnaissance role altogether. Consequently, air reconnaissance training in early 1942 became the near sole responsibility of the observation groups and the 1st Mapping Group, hardly the optimal solution given the inadequacy of observation doctrine and differences between photo mapping and photo intelligence. Similarly, in the chaotic days following the Japanese attack on Pearl Harbor, many observation units found themselves tasked with antisubmarine patrols. Only in June 1942 did most of the units get relieved of that responsibility. By May, the 2d Photographic Group assumed the reconnaissance training mission for the Air Corps.[54]

Air observation units likewise encountered problems. Aviation commanders lacked the authority to train squadrons assigned to ground units, a responsibility given to Army corps commanders. Therefore, standardization suffered as each corps acted independently. Throughout 1940, aerial observation training emphasized artillery fire adjustment, but only gradually did it expand to cover topics such as general reconnaissance and aerial photography.[55] An Office of Chief of Air Corps inspection of observation units concluded too many chains of command existed, and that the "nature of

missions performed [by observation squadrons] depends on the individual interest of the ground commanders."[56] Major General George Brett, Chief of the Air Corps, remarked in June 1941 that observation units were "more or less orphans."[57]

To a larger degree than other combat units, aerial reconnaissance training faced extreme shortages in personnel and aircraft, and shortcomings in training content and length threatened its ability to produce effective aircrew. Personnel shortfalls affected observation units the most since many had National Guard origins, and those units had substantial shortfalls in all specialties on the eve of Pearl Harbor. The problem once again derived from a higher priority placed on filling pilots in combat units. Though at first glance this appears shortsighted, it stemmed from not only the many resource requirements, but also the untested nature of reconnaissance. An inspection of the 68th Observation Group in April 1942 discovered it had not received a new pilot since the summer of 1941. Even in October, an AAC directive reduced four of five observation groups in the II Air Support Command (ASC) and three of the six observation groups in the I and III ASCs to 50 percent of their authorized strength.[58]

Training also suffered from obsolete and insufficient numbers of aircraft. In December 1941, observation units only had light liaison aircraft for training. By August the following year, only three of the six observation groups possessed tactical aircraft, with a combined total of twelve A-20 light attack planes, and eleven P-40 and fourteen P-43 pursuit fighters. Similarly, the 71st Observation Group had only six light bombers and fifteen fighters by November 1942. Although more modern fighter and bomber aircraft would arrive, combat units held a higher priority for aircraft deliveries. Photo reconnaissance units enjoyed greater standing than observation units, and therefore faced

fewer aircraft shortages, but even they still did not have full aircraft authorization until 1944.[59] This dismal state of aircraft types and quantity significantly affected operations in North Africa. A post war study of reconnaissance training in 1941 and 1942 described Air Corps program as "more or less backward and chaotic."[60]

In addition to resource shortages, the training itself faced significant content and duration problems that post-war analysis later described as "unsettled and ill-planned" at the war's start.[61] With little to start from, overseas experience, particularly British, likely influenced the content and structure of photo and visual reconnaissance to a larger degree than any other Army Air Force training program.[62] Lieutenant Colonel David Hutchinson, the first commander of training at Peterson Field, Colorado, observed British reconnaissance units for several months in the fall 1941. His observations greatly shaped the first operational training unit established for newly created photo reconnaissance units. Meanwhile, the length of training suffered from theater demands for reconnaissance units, equipment availability for training, and maintenance difficulties.[63]

Based on these shortcomings, some units devised their own training. Per First Lieutenant Robert Boyle, the 12th Photo Reconnaissance Squadron ground echelon commander, most of the unit's pilots that arrived in the spring of 1942 came straight from advanced flying school without high altitude photo reconnaissance training.[64] Consequently, the unit sent pilots to Lowry Field, Colorado, for a month of aerial photography training, followed by practical training missions with the squadron that involved high-altitude operations under simulated combat conditions. The training focused on navigation and basic tactics, such as photographing pinpoint and strip targets from multiple perspectives. Missions averaged three to five hours and pilots had to

complete fifty hours of training for a total of ten to fifteen missions.[65] Lieutenant Boyle summarized the purpose, "[The pilot's] duty was to get his pictures and to get back home with them. This was drilled into him time after time, and the fact was emphasized that the lives of thousands of men on the ground might, and in many cases did, depend on the information which he brought back with him."[66]

While attaining the images required trained aircrews, photo interpretation also needed skilled personnel. Fundamentally, accurate interpretation only developed with knowledge, training, and experience. In response to the growing demand for intelligence analysts, the Army established the Military Intelligence Training Center in May 1942 at Camp Ritchie, Maryland. While initiated as a school for prisoner interrogators, the Army recognized the need for other specialists such as photo interpreters and expanded the course in October to include the subject. Duties of the Photo Interpreter Teams included:

    1. Procurement of aerial photographs

    2. Preparing photo overlays and annotations with enemy positions and plans

    3. Terrain estimates from aerial photos

    4. Identify and locate enemy material

    5. Report the condition of roads, bridges, and railroads

    6. Construct aerial photo mosaic maps[67]

These teams became the primary interpreters of photos destined to support ground units.

The Air Corps also established training for its photo interpreters and photo lab personnel to satisfy the intelligence requirements for its units that differed from Army units. The Air Corps Technical School moved to Lowry Field, Colorado, in early 1938 and its first class started 28 February, though it never really progressed beyond basic

photography mechanics. By August 1939, it had expanded to a three-month course that included four weeks of basic photography, five weeks of ground photography, one week of aerial photography, and one week of mosaic making and film trailer operations. After Germany invaded Poland the following month, Army engineers arrived to teach topography and the officer's course expanded to six months. Like other reconnaissance elements, interpretation also learned from Britain's experience. Captain Harvey Brown visited the photo interpretation center at Medmenham and learned from British experts the incredible amount of information aerial photos could reveal. His return to the United States helped improve the training program. Similar to the training content shortfalls with arriving pilots, reconnaissance squadrons established supplemental training programs that covered such basic topics as photography theory and lab work.[68] This curriculum pointed to the inadequacy of the centralized schoolhouses to provide trained personnel to these units. Not only did the units have to contend with resource, unit bed-down, and cohesion issues, they also faced significant training deficiencies.

Training materials supporting these programs included many of the field manuals described previously and training manuals such as Technical Manual 5-240, *Aerial Photographic Mapping, 1941*. Collectively these sources provided elementary and advanced understanding as well as techniques needed for observation and photo reconnaissance employment, and photo interpretation. In addition, officers from the Army Air Force Staff Photographic Section in Washington visited various training stations to promote standardization and a rigid schedule for newly formed squadrons.[69] In late 1942, the Army Air Force Intelligence School at Harrisburg, Pennsylvania, created *Photo Intelligence for Combat Aviation* as part of focused photo interpretation instruction

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for officers following the basic photography training at Lowry Field. In fact, the school created the manual itself due to the "scarcity of text material on this subject . . . due to [a] lack of operating experience in the U.S. Army."[70] While focused on support to the air operations, the manual briefly described support to ground forces and referenced a future manual that would cover the topic in greater depth.[71]

The Intelligence School's manual covered three other important factors. First, whereas support to strategic bombing missions may have had less urgency, ground forces needed information immediately. Therefore, while downplaying the ability of visual observation to see everything accurately, the manual did acknowledge its quicker dissemination. Next, based on subject matter expertise, Army photo interpreters attached to reconnaissance units would provide the best interpretation of enemy ground units because they understood enemy organization, equipment, and employment doctrine.[72] Finally, the manual provided interpreters a guidebook on administrative and specific content for writing reports. Overall, *Photo Intelligence for Combat Aviation* furnished a solid foundation before North Africa given the limited experience it drew from.

One of the most striking omissions throughout these various manuals is the lack of guidance on identifying enemy or friendly equipment, both in training and reference aids. While Army Air Force reference images covered terrain features and man-made structures, optimal manuals would have included views of various equipment pieces from different perspectives in varying scales and amongst different terrain types. This omission greatly contributed to the poor training of photo interpreters before North Africa. The lack of equipment photos primarily stemmed from limited American coverage of enemy forces up to that point in the war. It is possible the school used

supplementary training aids based on British photographic coverage of enemy ground units, but that remains unknown.

In addition to training reconnaissance personnel, Army intelligence personnel required a working knowledge of aerial reconnaissance. Field Manual 21-25, *Elementary Map & Aerial Photograph Reading, 1941*, emphasized the importance of training all personnel in photo reading since they frequently served as map substitutes or, in the absence of current maps, replacements. Similarly, Field Manual 30-5, *Combat Intelligence, 1940*, identified a need for training division and regiment intelligence personnel in aerial photos and tasking procedures, but it left training to respective division (G-2) and regiment (S-2) intelligence officers. This decentralized approach lacked standardization and depended on individual initiative to implement a program.[73]

In a detailed examination of the development and training of division, regiment, and battalion intelligence personnel, Phillip Wright concluded that on the eve of World War II the Army, in contradiction to stated doctrine, viewed the regiment and battalion positions as easily mastered skills. In the 1920s and 1930s, the intelligence branch held little prestige and became a dumping ground for officers unable to command. Consequently, the Army provided limited training opportunities to standardize the skills for these personnel. What training existed largely focused on ground patrols; therefore, field manuals likely provided the extent of an average S-2's understanding of aerial reconnaissance capabilities and tasking procedures. Division G-2s fared somewhat better with seventeen to twenty-five hours of instruction at the Army's Command and General Staff College together with future battalion, regiment, and division commanders.[74] As

reconnaissance units entered North Africa in late 1942, some of the most important ground unit users had limited insight on its applicability to their operations.

Technology and Equipment

Aerial reconnaissance doctrine in 1942 depended in large part on the technology of the day. Mirroring the distinction between reconnaissance and observation units, the aviators sought aircraft to suit these competing requirements. In the late 1930s, the Army Air Force decided multi-engine bombers would best satisfy air reconnaissance units since they would have the same aircraft type as the bomber units they would support. This partly resulted from the interwar emphasis on mapping as the primary mission of photo reconnaissance. As such, the Army Air Force converted twin-engine A-20 attack aircraft for photo reconnaissance, giving them the designation F-3. Though their performance in daylight proved unsatisfactory, the F-3 later became the primary night photo reconnaissance aircraft. Observation planes, on the other hand, had to operate near the front on unprepared airstrips; therefore, the Army pursued light liaison aircraft such as the YO-49 and O-52.[75] (see figures 11 and 12) Both of these assumptions later proved deficient against German fighters, first by the British and later by the Americans.

As the British experience exposed the inadequacies of bomber and light aircraft, the Army Air Force gradually transitioned to fighter aircraft. Some in the Army staff objected to fighters due to a perception that fighter pilots lacked the discipline to fly straight and level missions, especially for mapping. In February 1941, the War Department decided trained reconnaissance pilots would fly reconnaissance missions, not fighter pilots. This directive also prevented any stigma associated with converting fighter pilots to the perceived less glamorous reconnaissance missions.[76]

Figure 11. YO-49 Observation Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force,"
http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

Figure 12. O-52 Observation Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force,"
http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

Eventually reality prevailed and the Army Air Force pursued fighter aircraft, but
again for the purpose of mapping and long-range reconnaissance. It converted some P-39
and P-40s in 1941 that later served in North Africa in the 68th Observation Group, yet
these proved inadequate against German front-line fighters like the ME-109. (see figures
13 and 14) Later in December, it committed 100 P-38s to photo reconnaissance. This
involved replacing the four .50-caliber machine guns in the nose with mountings for
oblique and vertical cameras. This placement allowed the pilot to aim the cameras more

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easily while the aircraft's large nose provided maximum flexibility with various camera configurations, unlike the limited capacity of the P-39 and P-40s. Pilots flying unarmed P-38s depended on high altitude and speed as their primary defense. To distinguish this version from armed P-38s, the aircraft assumed the designation F-4. (see figure 9) Modifications to the F-4s in mid-1942 improved its speed and range, and became the F-5 to distinguish the difference. The P-51 was the final fighter type converted before Operation TORCH, designated F-6, and partly stemmed from the British success with the same aircraft. Unlike the F-5, the F-6 retained its "teeth" with machine guns in the wings and the cameras in the fuselage behind the pilot.[77] (see figure 15)

The transition to newer, more capable aircraft required time. By 1 February 1942, only four photographic reconnaissance squadrons existed in the Army Air Force. Based on their aerial charting training and experience, they became mapping squadrons, and therefore were not as fully prepared to support more general photo intelligence. As late as December, the Army Air Force had forty-seven observation squadrons with thirty-five fighters of various types and sixty-two light bombers of different types.[78]

Figure 13. P-39 Airacobra Pursuit Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force," http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

Figure 14. P-40 Warhawk Pursuit Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force,"
http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

Figure 15. P-51 Pursuit Aircraft or F-6 Tactical Reconnaissance Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force,"
http://www.nationalmuseum.af.mil/research/aircraft (accessed 7 December 2008).

Ultimately, one of the most important pieces of equipment was the camera itself.

The pre-war necessity of aerial charts for commercial aviation placed an emphasis on

technology related to map-making versus military intelligence. The main difference

between the two being area coverage versus photographic detail. Though camera

developers never developed a true reconnaissance camera, they managed to build the

fundamental technology needed for both missions despite regular funding shortfalls.

Camera development became a continual compromise between wide-angle coverage to minimize the risk over enemy territory, and focal length to achieve the greatest detail. By Operation TORCH, the Army Air Force had developed many of the fundamental facets of camera technology needed. These included:

1. Electrically driven film magazines

2. Between the lens shutter for sharper definition

3. Intervalometers that timed photos at regular intervals based on aircraft speed to achieve the 60 percent overlap needed for stereo image pairs

4. Night photography using flash bombs for illumination

5. Wide angle or multi-lens designs for area coverage to minimize distortion

6. Shutterless strip cameras for ultra low-altitude missions

7. A range of focal lengths from six to thirty-six inches to balance area and detail

At the war's start, the Army Air Force largely depended on six different cameras; each with their own unique capabilities in film size, shutter location (focal or between the lens), lens configurations, and focal lengths.[79] They provided the flexibility to employ aircraft at varying altitudes in different threat situations to meet diverse requirements.

Conclusion

On the eve of Operation TORCH, aerial reconnaissance units faced a number of significant challenges. The repeated organizational and doctrinal changes affected command and control, force development, and training. This situation helped result in the poor use of observation units attached to the Army and reconnaissance units serving with bombardment units. Experience in ground maneuvers reflected these shortcomings when ground units had missions flown over the same locations for long periods, or

communication problems caused duplication. It also reflected the larger struggle between

the Army Air Force and Army over the former's desire to exercise autonomous control of

airpower, while still needing to meet the ground commander's requirements. As

Lieutenant General McNair had observed, ground commanders felt a need to have every

capability organically contained within the unit. Added to this, reconnaissance units

faced resource shortfalls that continually relegated it to a low priority for new aircraft and

personnel. While the service drew from the British experience, in many ways it had not

progressed significantly beyond the ideas of World War I.[80]

Not everything was negative. Despite the doctrine shortfalls and lack of depth on

certain subjects, especially the diffusion of content between so many field manuals, the

doctrine provided adequate of the basic processes and concepts needed to execute the

1945 ground campaigns in the Mediterranean. Clearly, a significant contributing factor

was British experience, without which American units would have had a much steeper

learning curve. The other significant bright spot came in the area of technology. The

Army Air Force built on twenty years of testing experience to have more than adequate

camera capabilities at the war's start, and at worst were likely only second to the British.

[1]Robert Futrell, *Command of Observation Aviation: A Study in Control of Tactical Airpower* (Maxwell AFB: Air University, 1956), viii.

[2]Ibid., 1.

[3]In 1936, the corps existed conceptually; no active corps actually existed.

[4]Ibid., 1-2.

[5]The Army Air Force sent Lieutenant Colonel Kenney to observe both air forces in a combat environment while still officially not at war with Germany. His and other observers' insights shaped the future direction of aerial reconnaissance. Ibid., 6-7.

[6]Stanley, *World War II*, 32-33; Futrell, *Command of Observation Aviation*, 8-9, 15.

[7]Futrell, *Command of Observation Aviation*, 10-11.

[8]Ibid., 8, 11.

[9]War Department, Army Field Manual 30-10, *Military Intelligence--Observation* (Washington, DC: Government Printing Office, 1940), 3.

[10]The Army Air Corps was reorganized as the Army Air Forces in June 1941. Futrell, *Command of Observation Aviation*, 12-14.

[11]War Department, Army Field Manual 31-35, *Aviation in Support of Ground Forces* (Washington, DC: Government Printing Office, 1942), Chapter 3, paragraphs 51 and 53.

[12]War Department, *Training Circular, No. 36* (War Department, 1942).

[13]Futrell, *Command of Observation Aviation*, 21.

[14]Ibid., 19.

[15]Ibid., 15-16.

[16]War Department, Army Field Manual 30-21, *Military Intelligence--Role of Aerial Photography* (Washington, DC: Government Printing Office, 1940), 1.

[17]Today's Air Force recognizes this as Non-Traditional Intelligence Surveillance and Reconnaissance (NTISR). War Department, Army Field Manual 30-10, 5.

[18]These are the major field manuals on aerial reconnaissance leading up to operations in North Africa: Field Manual 1-20, *Tactics and Technique of Air Reconnaissance and Observation, 1942*; Field Manual 1-35, *Aerial Photography, 1941*; Field Manual 1-40, *Intelligence Procedure in Aviation Units, 1940*; Field Manual 21-25, *Elementary Map & Aerial Photograph Reading, 1941*; Field Manual 21-26, *Advanced Map & Aerial Photograph Reading, 1941*; Field Manual 30-5, *Combat Intelligence, 1940*; Field Manual 30-10, *Observation, 1940*; Field Manual 30-21, *Military Intelligence - Role of Aerial Photography, 1940*; Field Manual 31-35, *Aviation in support of Ground Forces, 1942*.

[19]War Department, Army Air Force Field Manual 1-20, *Tactics and Technique of Air Reconnaissance and Observation* (Washington, DC: Government Printing Office, 1942), 1-2, 42.

[20]Ibid., 15, 43-44, 58.

[21]Ibid., 51.

[22]Ibid., 50-54, 58-61.

[23]War Department, Air Corps Field Manual 1-35, *Aerial Photography* (Washington, DC: Government Printing Office, 1941), 2-3, 6.

[24]War Department, Army Field Manual 30-21, 4; War Department, Air Corps Field Manual 1-35, 39-40.

[25]War Department, Air Corps Field Manual 1-35, 11-14; 3rd Photo Group, 49.

[26]War Department, Army Field Manual 30-5, *Military Intelligence--Combat Intelligence* (Washington, DC: Government Printing Office, 1940), 14.

[27]War Department, Air Corps Field Manual 1-35, 22; War Department, Army Field Manual 30-21, 7.

[28]War Department, Air Corps Field Manual 1-35, 22; War Department, Army Field Manual 30-21, 7, 9.

[29]These EEIs are known today as priority intelligence requirements.

[30]War Department, Army Field Manual 30-21, 9; War Department, Army Field Manual 30-5, 7-8, 18; War Department, Air Corps Field Manual 1-35, 23, 26.

[31]War Department, Army Field Manual 30-10, 1-2, 5-6.

[32]War Department, Army Field Manual 30-21, 7-8.

[33]Ibid., 3-4.

[34]War Department, Army Field Manual 21-25, *Elementary Map and Aerial Photograph Reading* (Washington, DC: Government Printing Office, 1941), 90-91; Ian Hogg, German Artillery of World War Two (Mechanicsburg, PA: Stackpole Books, 2002), 167.

[35]War Department, Army Air Force Field Manual 1-20, 3-5; War Department, Army Field Manual 21-26, *Advanced Map and Aerial Photograph Reading* (Washington, DC: Government Printing Office, 1941), 120; Roy M. Stanley, *To Fool a Glass Eye: Camouflage Versus Photoreconnaissance in World War II* (Washington, DC: Smithsonian Institute Press, 1998), 29; War Department, Army Field Manual 21-25, 88.

[36]War Department, Army Air Force Field Manual 1-20, 6-7, 9-10.

[37]War Department, Air Corps Field Manual 1-40, *Intelligence Procedure in Aviation Units* (Washington, DC: Government Printing Office, 1940), 43-44, 49-50; War

Department, Air Corps Field Manual 1-35, 28-29; War Department, Army Air Force Field Manual 1-20, 8-9, 11, 14.

[38]War Department, Army Air Force Field Manual 1-20, 7-9, 16; War Department, Air Corps Field Manual 1-35, 16-17, 28; Grover Heiman, *Aerial Photography: The Story of Aerial Mapping and Reconnaissance* (New York: Macmillan Company, 1972), 59.

[39]Army Air Forces Intelligence School, *Photo Intelligence for Combat Aviation* (Harrisburg: Army Air Forces Intelligence School, 1942), 14-15.

[40]Futrell, *Command of Observation Aviation*, 3; War Department, Army Air Force Field Manual 1-20, 9-10, 14-15.

[41]Futrell, *Command of Observation Aviation*, 10.

[42]War Department, Air Corps Field Manual 1-35, 31-37.

[43]Stanley, *To Fool a Glass Eye*, 13.

[44]War Department, Army Air Force Field Manual 1-20, 13, 47-48.

[45]War Department, Army Field Manual 30-21, 6, 17-19; War Department, Army Field Manual 21-26, 114-116; Stanley, *To Fool a Glass Eye*, 13; War Department, Army Air Force Field Manual 1-20, 5-6, 11-12.

[46]Stanley, *To Fool a Glass Eye*, 18, 21; War Department, Army Field Manual 30-21, 28.

[47]War Department, Army Field Manual 30-21, 21.

[48]Stanley, *To Fool a Glass Eye*, 21, 33, 35-36, 43, 46; War Department, Army Field Manual 30-21, 19.

[49]War Department, Army Field Manual 30-21, 5; Heiman, 79, 82; Army Air Forces Intelligence School, 175-176.

[50]The "nine-line" is a modern method air and ground personnel pass information in a standardized format. The "nine-line" includes information on nine major details such as target location, target description, target elevation, the location of friendly forces, etc. War Department, Army Field Manual 30-5, 10, 14; War Department, Air Corps Field Manual 1-40, 19.

[51]Army Air Forces Intelligence School, 15-16; War Department, Air Corps Field Manual 1-35, 30; War Department, Army Field Manual 30-21, 9-11.

[52]War Department, Army Air Force Field Manual 1-20, 42; War Department, Army Field Manual 30-21, 13.

[53]War Department, Army Field Manual 30-21, 14-16, 21, 24-28, 30, 32; War Department, Air Corps Field Manual 1-35, 16-17.

[54]War Department, Air Corps Field Manual 1-40, 37; Air Historical Office, Headquarters, United States Air Force, *Army Air Forces Historical Studies: No 61 - Combat Crew and Unit Training in the AAF 1939-1945* (Air Historical Office, 1949), 73-75.

[55]Futrell, *Command of Observation Aviation*, 9; Heiman, 89.

[56]Futrell, *Command of Observation Aviation*, 9-10.

[57]Ibid., 3.

[58]Air Historical Office, *Army Air Forces Historical Studies: No 61*, 79-80.

[59]Ibid., 78, 81-82.

[60]Ibid., 76.

[61]Ibid., 82.

[62]The Army Air Corps (AAC) became the Army Air Force (AAF) in June 1941. Geoffrey Perret, *Winged Victory: The Army Air Forces in World War II* (New York: Random House, 1993), 55

[63]Air Historical Office, *Army Air Forces Historical Studies: No 61*, 82, 84.

[64]Lieutenant Boyle actually served as a pilot during WWI, and therefore had some operational experience despite not flying in the WWII.

[65]Robert Boyle, "History of Photo Reconnaissance in North Africa Including My Experiences with the 3rd Photo Group" (PhD diss., University of Texas, 1948), 9-12, 20.

[66]Boyle, 14.

[67]War Department, Army Field Manual 30-21, 17; U.S. Army, "A Brief History of MI Training," Military Intelligence Heritage, http://huachuca-www.army.mil/History/html/3mihist.html (accessed 2 December 2008), 11-12; The General Board, United States Forces, European Theater, *Military Intelligence Service in the European Theater of Operations - Study Number 12*, 27.

[68]John Kreis, ed., *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II* (Washington, DC: Air Force History and Museums Program, 1996), 81; Glenn Infield, *Unarmed and Unafraid* (London: Macmillan Company, 1970), 61, 63; Boyle, 24.

[69]Boyle, 18, 24.

[70]Army Air Forces Intelligence School, 2.

[71]Ibid., 3, 169.

[72]Ibid., 6-7, 18, 173; War Department, Army Field Manual 30-21, 5-6.

[73]War Department, Army Field Manual 21-25, 71; War Department, Army Field Manual 30-5, 31-33.

[74]Phillip Wright, "Tactical Intelligence Staff (S-2) Operations in North Africa and the European Theater and the Creation of the U.S. Army's Military Intelligence Branch" (master's thesis, U.S. Army Command and General Staff College, 1996), 27-28; Robert Futrell, "U.S. Army Air Forces Intelligence in the Second World War," in *The Conduct of the Air War in the Second World War*, ed. Horst Boog, 527-552 (New York: Berg, 1992), 528.

[75]Futrell, *Command of Observation Aviation*, 5; Stanley, *World War*, 82-83.

[76]Stanley, *World War II*, 77-78.

[77]Within the F-5 designation, variants ran from F-5As through F-5Hs. Similarly, F-6s existed as F-6A through D and F-6K versions. Ibid., 83, 89-90; Heiman, 92.

[78]Boyle, 307; Futrell, *Command of Observation Aviation*, 18; Stanley, *World War II*, 133.

[79]The six main camera types included the K-17, K-18, K-19, K-21, K-24, and the S-2. The F-5 (P-38) accepted a dozen different configurations of the K-17, K-18, and K-22 camera types alone. Heiman, 58, 62-64, 68, 71, 78; Stanley, *World War II*, 133, 135, 137, 147, 151.

[80]Robert Futrell, *Command of Observation Aviation: A Study in Control of Tactical Airpower* (Maxwell AFB: Air University, 1956), 19-21.

CHAPTER 3

NORTH AFRICA: CUTTING TEETH

Overview

Allied political and military leaders decided to invade North Africa to divert German attention from the Soviet Union, and conduct an operation with a reasonable expectation of success as forces continued to build for the invasion of mainland Europe. The invasion of North Africa, code-named Operation TORCH, occurred on 8 November 1942 at Casablanca, Morocco, and Algiers and Oran, Algeria. (see figures 16 to 18) American forces landed at Oran and near Casablanca, while British units, under an American General, assaulted Algiers. French forces at all three locations offered a relatively inept defense and days later on the 13th, the French in North Africa agreed to support the Allies.[1]

Figure 16. Operation TORCH, North Africa, November 1942
Source: World War II, European Theater, "Pursuit To Tunisia, November 1942-February 1943," U.S. Military Academy, http://www.dean.usma.edu/history/web03/atlases/ww2%20europe/EuropeanTheaterGIF/WWIIEurope38Combined.gif (accessed 11 March 2009).
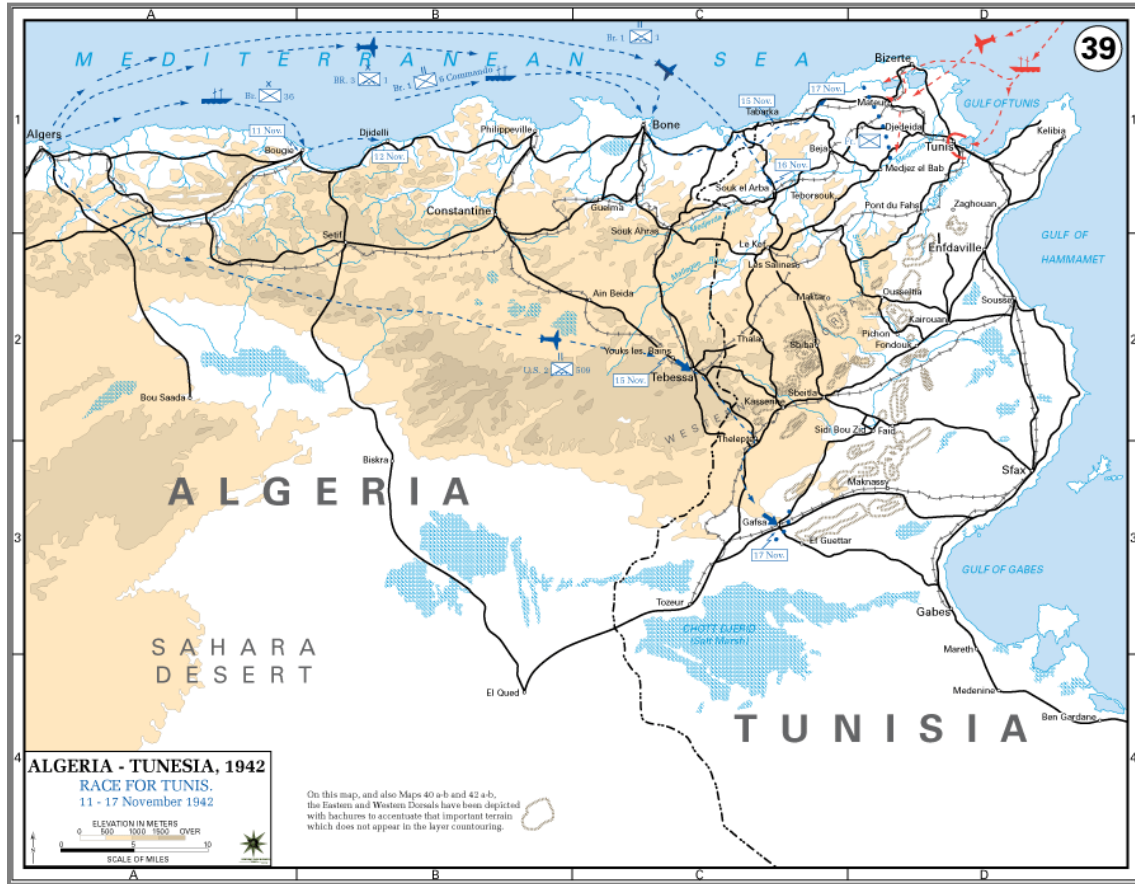
Figure 17. North Africa, November 1942

Source: World War II, European Theater, "The Race For Tunis, 11-17 November 1942," U.S. Military Academy, http://www.dean.usma.edu/history/web03/atlases/ww2%20euro pe/EuropeanTheaterGIF/WWIIEurope39.gif (accessed 11 March 2009).

Figure 18. Tunisia, April 1942
Source: World War II, European Theater, "Tunisia, Situation 22 April 1943," U.S. Military Academy, http://www.dean.usma.edu/history/web03/atlases/ww2%20europe/E uropeanTheaterGIF/WWIIEurope42Combined.gif (accessed 11 March 2009).

With secure bridgeheads, Allied forces turned east toward Tunisia, to linkup with the British forces driving west from Egypt. This action placed German and Italian armies between two field armies seeking to drive the Axis from North Africa. Allied forces quickly advanced across the rugged desert, and reached Tunisia by month's end. After a series of battles, the campaign stalled in late December 1942. In January, the focus became roads and key terrain in central and southern Tunisia to prevent a linkup between retreating German forces in Libya and those in northern Tunisia. A series of battles resulted, including the infamous Battle of Kasserine Pass. The defeats suffered in January and February forced allied leaders to reorganize and replace many in key leadership positions. With units refitted and reorganized, and Axis forces increasingly isolated, German and Italian forces were attrited until they surrendered in early May.[2]

North Africa marked one of the first combat tests of aerial reconnaissance doctrine and faced many challenges. Reconnaissance units initially struggled to overcome inadequate resources, poor aircraft capabilities, and a decentralized organizational structure. To correct these problems, units changed tactics and techniques, and implemented a number of material solutions. The North Africa experience eventually compelled a reorganization of tactical air doctrine and observation reconnaissance.[3] The lessons garnered there had major ramifications for the entire reconnaissance program within the Army Air Force, from aircraft and camera improvements, to changes in training and photo production capabilities.

<u>Planning</u>

American aerial reconnaissance contributed little to the planning or the actual invasion. Royal Air Force (RAF) units in Malta and Gibraltar flew the missions, while

interpreters based at the Central Intelligence Unit, Medmenham, England provided photo exploitation before the invasion. Some Army Air Force personnel such as Captain Clyde Butler played a part in this effort, but most lacked the necessary experience to be effective. As described by Major Audubon Tyler, chief of the 13th Photo Intelligence Detachment, "the British Army and the R.A.F. were obliged to furnish the majority of the personnel required for the initial weeks of the Tunisian campaign."[4]

Organization

To support the campaign, the Eighth Air Force transferred several reconnaissance units from England to the operation; while others arrived directly from the United States. The 12th Air Force supported the Center Task Force assault on Oran supported by the 3d Photo Reconnaissance Group, hereafter referred to as 3d Group. The XII Ground Air-Support Command, later the XII Air Support Command (ASC), supported the Western Task Force landings at Casablanca. The XII ASC contained the 68th Observation Group with the 16th, 111th, 122d, and 154th Observation Squadrons. None of these units directly supported the landings, and at least some 68th elements went ashore on D-day.[5]

It took time for the various units to consolidate their equipment and personnel. As late as 26 November 1942, neither the 12th Photo Reconnaissance Squadron nor the 68th Observation Group had its aircraft.[6] Eventually the observation units united at Oujda, Algeria, with their P-39s and A-20s. From there the 16th and 122d spent the next three months conducting anti-submarine patrols, and thus provided nothing to ground force units. The 111th helped defend Oran so that only the 154th supported ground combat operations. Meanwhile, the 3d Group sent its squadrons overseas in parts to prevent the group's destruction if the Germans sank one or two ships. Given this

staggered movement plan, Lieutenant Robert Boyle selected the older men in his unit to deploy first to have the greatest possible experience available. The group's personnel and equipment arrived in phases at different locations and started only limited operations in late November.[7] Compounding this problem, the reconnaissance units lacked organic transportation to move and regroup. Ultimately, the unit reformed at Algiers, Algeria, in late December where it remained until Tunisia fell.[8] Over its first few months of operations, 3d Group faced a number of organizational changes.

In October 1942, before the 3d Group even reached North Africa, its commander, Lieutenant Colonel Elliot Roosevelt, reorganized to accommodate personnel shortfalls.[9] He centralized laboratory and interpretation resources to meet the anticipated photo requests and overcame the personnel shortage by effectively disbanding the squadrons, except for accountability purposes, because of their inability to operate independently. All personnel worked for the group in one of five sections, Mission Planning, Field Operations, Photographic, Photo Mapping, and Administration. This organization remained in place for the entire North African campaign partly because the group had at least ninety empty positions until late summer 1943.[10]

The second major modification mirrored the merger of the 12th Air Force and British RAF Eastern Air Command into the Northwest African Air Force (NAAF). This marriage brought together the 3d Group and the No. 4 Photo Reconnaissance Unit into the Northwest African Photographic Reconnaissance Wing (NAPRW) on 18 February 1943 under Colonel Roosevelt with Wing Commander Eric Fuller, RAF, as his deputy.[11] This reorganization aimed to correct reporting inaccuracies and to reduce duplication problems through greater coordination of taskings. This truly became a coalition

operation, with one French group, and one RAF, one South African, and four U.S. squadrons by September 1943.[12] Since no provision had been made for the NAPRW, personnel came from the 3d Group until April 1943 when personnel from other unit's became available. Only in October 1943 did the wing "assume its full functions."[13] Until that time, the wing handled policy, but pushed many responsibilities to the group.[14]

In contrast to the idea of centralization, a third organizational change started in January 1943 with self-contained detachments to work for supported air and ground units "for more immediate demand-control and to expedite delivery of first phase interpretation reports."[15] These advance units served in addition to the wing and group headquarters at Algiers, and contained a flight of four to six aircraft, a first phase interpretation section, and a laboratory. The first detachment supported the strategic air force headquarters at Telergma, Algeria, but based on its success, a second forward unit stood up in March at Souk El Khemis, Algeria, with the British First Army, another on Malta with the RAF, and a fourth at Oujda, Algeria. The 3d Group selected the most experienced men for this duty and rotated them through on a periodic basis.[16] This technique provided a good first impression representing the unit, improved support to combat units, and helped the interpreters better understand what supported units needed.

Operations

Once operational, reconnaissance units faced a myriad of challenges that significantly degraded their ability to support ground units, especially in the initial phases. Aircraft difficulties immediately came to the forefront as units quickly found themselves outmatched. The 15th Photo Mapping Squadron employed B-17s for mapping, or at least attempted to do so. Flying as single aircraft, B-17s met near disaster.

One crew faced seven Me-109 fighters and suffered four wounded crewmembers before escaping into the clouds. Combined with German raids on the 15th's airfield that damaged other B-17s, the unit quickly discarded them in favor of F-4s. German fighters also outclassed the 154th's P-39s and P-40s performing visual reconnaissance. In fact, they frequently required escort packages as large as twelve fighters.[17]

Squadrons flying F-4s had their own obstacles. After a short time in operation, they sidelined older F-4s due to problems at higher altitudes and resorted to using only newer versions; yet even these variants had issues that required troubleshooting. This further delayed support to theater units until January 1943. With the collective loss of older F-4s and the B-17s, the group had only ten newer F-4As, of which 50 percent were non-operational. The situation worsened in February with only two operational aircraft when the group should have had thirty-nine F-4 variants between its three squadrons. With pilot losses of 25 percent during the same period, the 3d Group's operations ground to a virtual halt until F-5As began arriving in mid-March.[18]

Maintenance proved difficult as newly promoted Major Boyle, now the 3d Group Adjutant, remarked, "One of our large problems was to keep an adequate number of aircraft in operation in order that our pilots might obtain the pictures."[19] From his perspective, with reconnaissance units still proving their worth, combat units received priority for spare parts and replacement aircraft. Only creative solutions kept the aircraft operational.[20] The F-5A provided the solution, but only after units solved its engine problems to permit operation at high altitudes.[21]

A great deal of operational experimentation occurred in the field to improve the capabilities of the F-4 and F-5 variants. Foremost was a significant increase in range. At

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the campaign's start, they had a 150-mile range, but then increased to 400 miles in May 1943 and to 750 miles by September.[22] In a traditional land campaign, reconnaissance aircraft remained within 100 miles of the front and supported ground forces up to 150 to 200 miles behind enemy lines, thus 750 miles seemed excessive. However, when conducting missions from North Africa across the Mediterranean to Italy or southern France, this became vital since the distance from Tunis to Salerno is over 350 miles. This increased range allowed the aircraft to reach such distant areas with enough fuel to cover the targets in that area.

Aside from the other problems faced, the 3d Group required unique supplies and equipment not readily available from local sources. The demand for supplies became so great the group enlisted at least two B-17s from the 15th Photo Mapping Squadron for the sole purpose of resupply. The aircraft made weekly runs to England to obtain the needed materials, especially print paper, to continue operations.[23]

Terrain in certain areas presented another hurdle. While the desert and plateau areas of North Africa afforded easier reconnaissance, the XII ASC stated, "The hilly wooded terrain in northern Tunisia has made direct support extremely difficult by preventing positive identification of friendly and enemy front lines and material."[24] As some reports and G-2s identified, German troops mastered the use of camouflage and terrain and even used captured allied equipment that made the job that much harder.[25]

Support to Ground Operations

From at least mid-January to mid-April 1943, the XII ASC supported the II Corps under the British First Army. Its reconnaissance tasking for the period included covering the unit's front and flanks, but interestingly had the caveat "to provide photo

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reconnaissance whenever equipment was available."[26] The XII ASC lacked sufficient photo reconnaissance capability to satisfy II Corps' requirements and criticized the inability of the 3d Group and NAPRW to fulfill the requests. Only in April 1943 did the squadron receive P-51s able to help relieve the strain on the NAPRW. When the 154th transitioned to training duties at the end of April, its P-51s transferred to the 111th Observation Squadron to directly support the XII ASC.[27]

Command and control problems revealed themselves in January. When German attacks endangered the French XIX Corps, the U.S. II Corps refused their reconnaissance requests based on its lack of responsibility for that area, regardless of the lull in XII ASC missions. In separate instances, Brigadier General Laurence Kuter, the XII ASC Commander, criticized ground commanders for keeping twelve fighters over a battlefront despite evidence that such measures eliminated the escorts needed for reconnaissance sorties. A post-war analysis concluded ground commanders regularly used observation squadrons as ground attack aircraft resulting in a "definite deterioration of their reconnaissance value."[28] Despite this apparent misuse, the 154th flew 1,512 reconnaissance sorties in North Africa, of which thirty-eight were classified as photo reconnaissance.[29] Since the II Corps "controlled" the XII ASC, one must assume it permitted this situation to persist. Examples like this fueled arguments by Army Air Force leaders to centralize air assets.

Observers Lieutenant Colonel Albert Crowther and Major Burton Miles from the Headquarters Army Ground Forces witnessed similar troubles when they visited units between 27 January and 20 February 1943. Their report concluded the "supply of aerial photos for intelligence studies in this theater is unsatisfactory."[30] Interpretation reports

from November 1942 through March 1943 supported the claim with 159 total reports, an average of roughly one per day. They noted photo intelligence would have helped identify enemy positions difficult to observe visually by fast moving aircraft, and activity in rear areas beyond the reach of ground patrols.[31] Unfortunately as they noted, "American aerial photographic equipment is practically non-existent in the theater, and British equipment is limited."[32] These comments reflected the 3d Group's slow buildup and mirrored comments in after action reports.

The entire collection cycle functioned poorly throughout North Africa. Photo requirements submitted to the British First Army for one copy of stereo photos took on average twenty-four hours to receive the prints. In extreme cases, ground commanders did not receive reports for forty-eight hours. By the start of the Tunisian campaign, the great separation between photo reconnaissance units in Algiers and the First Army HQ added to the problem and caused "an inadequate service . . . for First Army."[33] As the front moved east, the 3d Group HQ became increasingly distant, in the later stages hundreds of miles away. As such, in some cases the British First Army had to depend on RAF reconnaissance elements serving the British Eighth Army, or the 154th.[34]

This problem somewhat eased when the First Army received a detachment from the 3d Group in March, but problems still persisted at lower levels. The 9th Infantry Division, here after referred to as the 9th Division, submitted a photo requirement on one occasion that the corps approved, yet it never received coverage. In another case, the division acted upon intelligence indicating limited German positions along the Gabes-Gafsa road in southern Tunisia. In reality, the Germans had heavily fortified the area and it faced significant resistance. The division believed that "aerial reconnaissance would

have disclosed much information," and it would not have attacked the way it did.[35] In contrast, the attack on Sedjenane, Tunisia, had sufficient maps and aerial photos to permit envelopment that flanked the German defenses and forced a withdrawal. While isolated cases, they left enough of an impression for the division to note them in its after action report for the period. Due to inadequate support from aerial reconnaissance assets, the division diverted its liaison aircraft from directing artillery fire to aerial reconnaissance.[36]

The 9th Division had similar complaints concerning observation reconnaissance support. Despite having its own air support party, "excessive" delays between requests, their approval or disapproval, and the execution negated the effectiveness of these missions. Army Air Force units claimed on several occasions it overflew areas and observed nothing, yet the division asserted that enemy movements could nullify the mission even just two to three hours after initiating a request. As a result, the division desired direct contact with aviation units to facilitate improved support.[37]

In fairness, the 3d Group and NAPRW had many units to support and the ground forces were not immune from blame. In January 1943, aviation units attacked airfields and ports to gain air superiority and interdict the flow of German reinforcements and supplies; both of which required support from aerial photos.[38] NAPRW photographed targets across the region for all services and greatly taxed its units. (see Table 2) Product timeliness always affected photo reconnaissance units, but they were not always at fault. When Major George Humbrecht, the 3d Group Executive Officer, received a request for an area he knew had been covered, he visited the British First Army HQ and discovered in his own words "not only . . . those pictures but a barn filled nearly to the haymow with photos . . . stored to await someone who could interpret them."[39]

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Table 2. Photo Collection Requests						
Type	November 1942	February 1943	April 1943	June 1943	August 1943	September 1943
Army	10%	26%	24%	18%	23%	27%
Mapping	--	--	21%	26%	24%	19%
Naval	40%	48%	16%	13%*	8%	9%
Air Force	30%	18%	21%	22%	17%	19%
General	20%	8%	18%	21%	28%	26%

Source: Robert Boyle, "History of Photo Reconnaissance in North Africa Including My Experiences with the 3rd PRG" (Ph.D. diss., University of Texas, 1948), 563.[40]

A partial solution came with the forward unit attached to the British First Army. It included approximately fifty personnel that initially worked from an airfield twenty-five miles behind the front lines. Such an austere location complicated aircraft operations and maintenance, and invited frequent German air attacks. The unit included five F-5s, six pilots, nineteen enlisted personnel, and a British unit of twenty-eight that included two liaison officers and six army interpreters. It worked closely with the army's photo center in direct support of its daily requirements for imagery. Liaisons played a pivotal role in identifying the requirements tasked via a joint board of British First and Eighth Armies, U.S. II Corps, and the French XIX Corps. In general, the unit flew missions before noon, and disseminated first phase reports by wire, presumably teleprinter or telephone, and prints and second phase reports by motorcycle. By the campaign's end, the First Army recognized that the number of pilots and aircraft available just met the peak periods of demand.[41] This organizational structure effectively gave ground commanders tactical control over their attached photo reconnaissance squadrons; a hallmark trait in this theater that continued through the Italian campaign.

Given the size of these detachments, the limited scale of photo production became the primary limitation. Even full squadrons had limited organic capability and by war's end groups had to depend on a single squadron that did nothing but produce photo prints from negatives to meet the demand. Thus, detachments likely could not meet the production demands needed to reach lower army echelons; NAPRW had to accomplish that scale of work. Even the Allied Force Headquarters (AFHQ) had to admit "the photographic section was greatly strained throughout the period."[42]

With the success of the forward units and more personnel, the 3d Group reorganized again. When the group and NAPRW relocated to Tunisia in June 1943, the group disbanded the five sections formed in January and returned to its squadrons. Henceforth, all forward units, except the one at Malta, would deploy as squadrons, and even the Malta unit later reorganized to form the 12th Photo Squadron. Despite returning sufficient personnel to each squadron to form a photo lab for independent operations, NAPRW retained their own lab due to the success of centralized interpretation.[43]

<div align="center">Tactics, Techniques and Procedures</div>

Once reconnaissance units received their tasking, they implemented a number of tactics and techniques to accomplish the mission and return the intelligence to the supported unit. Many of these evolved from those tactics discussed in Chapter 2 while others developed from experience and necessity. Their development centered on collection, interpretation, and dissemination improvements.

By 15 January 1943, the 3d Group established a Combat Intelligence section. This organization maintained awareness of enemy aircraft and air defense threats, and assisted pilots in locating their targets during mission planning. Major Lee Munroe took

charge of this section and quickly implemented the creation of target folders with all applicable information on a target area, the threats, optimal focal lengths, and radio and rescue procedures among other items. Prior to its creation, pilots usually exchanged this kind of information by simple word of mouth. Major Munroe's section better supported the forward units by giving them a starting point when they first stood up.[44] Centralizing and standardizing this information promoted a conscious awareness by everyone involved and elevated its importance in mission planning.

Enemy threats posed the greatest challenge to observation missions due to their lower operating altitude. As mentioned, P-39 observation missions initially flew as pairs with one pilot serving as the observer the other looking for threats, and at least twelve escort fighters for area reconnaissance. Over time, crews learned that spot missions of selected areas versus area reconnaissance helped reduce the escort requirement. Moreover, area reconnaissance proved less effective given the terrain and the very nature of trying to observe ground activity from fast moving aircraft. A related tactic involved giving escort fighters an area to defend between the anticipated threat and the observation aircraft rather than parking escorts over them and inadvertently drawing more ground fire. Though the threat never disappeared, this helped free the observation pilots to focus on ground activity and worry less about enemy aircraft.[45]

Photo reconnaissance pilots faced their fair share of threats as well. As covered in the field manuals, pilots quickly learned that keeping their heads in the cockpit meant sure destruction; they had to maintain vigilance in looking for enemy aircraft. Of the first 2,520 sorties covering operations across the theater into September 1943, 418 encountered enemy resistance, 193 from ground fire, known as flak, and 225 from

fighters. Fighters presented a greater threat because they forced a mission abort or at least a duck in the clouds, while large caliber flak at high altitude posed little more than a nuisance. Allied fighters even posed a threat since pilots could not wait to determine friend or foe; the first sight of a reacting aircraft caused a change in flight path. Casual observers commonly viewed F-5s as defenseless, but at least one pilot found his "equipment well suited . . . we could avoid the enemy [and] leave him behind on the rare occasions he managed to contact us."[46] Major Humbrecht similarly concluded that employing unarmed F-4s and F-5s at or above 20,000 feet proved very effective against Germany's front line fighters, the Me-109 and FW-190. Yet he cautioned, "We learned many of our tactics the hard way."[47]

Experience provided a critical boost in capability as demonstrated by the increased number of targets and area pilots photographed. Part of the difference stemmed from improved mission planning and debriefs as intelligence personnel and pilots worked more closely, built relationships, and exchanged tactical level knowledge and lessons. Pilots also reviewed mission photo prints with interpreters to understand how their skills, or lack thereof, affected the results. This continuous improvement became a source of strength since the unit understood better the relationship between technical capabilities and tactical employment. By September 1943, pilots covered twice as many pinpoint targets when compared to their initial efforts. In fact, one mission covered forty-one targets in a single mission over newly flown territory, an unheard of accomplishment at the time when pilots normally averaged twenty-five. Similarly, pilots became more efficient in mapping missions by minimizing the amount of sidelap between parallel flight lines that reduced wasted film and the exposure to Axis threats. One such mission

imaged 350 miles of photo strips in a single mission. Captain Joe Scalpone, a 12th Photo

Squadron pilot, noticed on his fifth mission the taskings over Tunisia changed from point

targets to strips and area coverage.[48] This required more concentration to stay straight

and level over a target and presented greater exposure to threats.

As photo reconnaissance units gained experience, they gradually learned what

techniques worked best. Pilots knew how to use holes in the weather to continue their

photo runs, or to give winds time to clear dust and debris from air strikes or artillery

before photographing a target. They also understood the value different focal lengths

provided. General coverage of new areas for familiarization or mapping purposes

required six-inch focal length cameras, where a single exposure at 1:50,000 covered a

seven by seven mile square. Twenty-four-inch cameras covered a three by 1.75 mile area

at an average scale of 1:12,500, but it had a limited ability to determine minor defenses.

Experience showed only the thirty-six inch cameras captured the detail needed to find

"minor defenses" and minefields due to the terrain and high altitudes flown, but the 3d

Group lacked any to support First Army.[49] Though twenty-four-inch cameras lacked the

detail needed and some lessons learned criticized its inability to uncover "minor

defenses," it is unrealistic to think that even thirty-six inch cameras could discover

everything, especially in rugged terrain with camouflage applied.

Once collected, interpreters had to exploit the photos. The 3d Group worked with

British 682d Squadron from the beginning when an interpretation element of 200

personnel joined the group in January 1943. Major Robert Boyle commented:

> Without the assistance of the British interpreters in the beginning, the photo
> interpretation work could not have been immediately successful. Their
> experience and training during nearly three years of warfare . . . made it possible

for both American and Allied Headquarters in North Africa to receive accurate photographic interpretation, which at that time American photo units actually were not capable of producing, simply because they had no personnel training in this intricate and exacting work.[50]

The relationship continued when the entire British Northwest African Central Interpretation Unit joined NAPRW during its creation.[51]

Following doctrine and the British example, interpretation involved the multi-phase process described previously. In this case first phase exploitation occurred at the airfield where up to three interpreters remained, while the headquarters issued second phase reports with the main body of interpreters. When the NAPRW relocated to Tunis in June, first and second phase exploitation merged, but the impact remained unchanged. Supported units immediately received a short synopsis followed later by detailed reports. As additional interpreters and facilities became available, the headquarters assumed third phase exploitation as well. In any case, most of the third phase analysis focused on locating suitable targets for strategic bombardment and the associated damage assessment of strikes. Interpretation proved a labor-intensive process, especially maintaining the library of previous coverage such as prints, negatives, ground plots, interpretation reports, and other sources of intelligence.[52] Interpreters referenced these products through a consolidated index map that kept track of all sorties flown and their respective coverage areas. By Major Audubon Tyler's own admission, "it was not until the close of the Tunisian campaign that they [American interpreters] were conceded full recognition."[53]

The inexperienced AAF interpreters in North Africa could not help but make mistakes. In one oft-repeated example from March 1943, American interpreters reported fifty enemy tanks moving toward American and British lines west of Tunis. Ground commanders shifted forces to deal with the new threat. Only later did a second

interpretation of the photo reveal the "tanks" were in fact camels. Cases like this and the

overall inexperience forced units to focus on training of ground personnel, even during

combat, to hone and enhance skills not taught during initial training. The 3d Group

received 152 personnel from October 1942 to March 1943 that needed such training. To

add to the realism, trainees used real world mission photos.[54]

Beyond NAPRW, several interpretation elements provided unique support to

ground units. The ground forces themselves established interpretation units at the Army

level at a minimum to supplement NAPRW and provide exploitation unique to army

requirements. It is likely they provide first and second phase exploitation support, and

probably evolved into the photo centers of later campaigns. For third phase exploitation,

an "Army Section" existed at NAPRW to assist planning efforts associated with future

operations. NAPRW trained these Army interpreters, along with Army Air Force

interpreters. Some of the former later deployed with the 5th Photo Squadron to Italy.[55]

The final task of reconnaissance units involved getting the intelligence to the

supported units. Observation aircraft possessed VHF radios to pass urgent information

directly to the air support parties associated with each division G-3, otherwise routine

reports waited until after the aircraft returned to base. Radio reports opened such

information to enemy signals intelligence collection, and invited Germans attempts to

move its forces before ground commanders could respond. Due to the distance between

NAPRW and the field units, courier flights helped pass film prints and taskings between

units, especially the forward units detached from the main headquarters. Since couriers

supplied the "basic form of communication it must be given the 1st Priority."[56] Thus,

courier missions even received priority over operational missions.[57]

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Effect

Although aerial reconnaissance faced many difficulties, the situation improved by the campaign's end and even scored some successes. Toward the end of the Tunisian campaign, NAPRW flew a short-notice mission that covered the entire territory in Axis hands, except Cape Bone, and built a photo mosaic within seventy-two hours. This mission provided planners critical information on terrain and defensive emplacements. In a separate case, ground units planned a final major offensive on 3 May 1943 to capture Tunis and Bizerte, Tunisia. Poor weather prevented photo reconnaissance missions; therefore, the Army delayed the operation four days until the missions were finished. Based on the photos of Axis defensive positions, the operation captured both objectives within twenty-four hours of its start.[58]

Ultimately, NAPRW flew 191 reconnaissance and mapping missions in support of ground and air taskings over North Africa from November 1942 to May 1943. In addition, the second forward unit attached to First Army flew an additional 103 reconnaissance missions. Their observation counterparts in the 154th flew 1,512 sorties from mid-January to mi-April alone, of which thirty-eight were photo reconnaissance.[59] According to Major Boyle, ground liaison officers visiting the front returned to the 3d Group with stories that "every doughboy goes over the top with one of our pictures in hand," which subsequently became, "not a GI will go over the top unless he has one of our pictures in his hand.[60] How true this impression was is impossible to say, but in late 1943, AFHQ Intelligence Training Center training materials stated, "Aerial photographs were non-existent for bns [battalions] in Tunisia."[61] Colonel Oscar Koch, a senior officer in the II Corps G-2 section, echoed these comments:

Air reconnaissance was rather limited, since the emphasis had been switched from close-in tactical missions to ones of a longer range strategic nature. We were provided with some air photos, but invariably they were fewer than the number we'd requested.[62]

Given the collective comments of lessons learned and the observers, it is unlikely these remarks held a great deal of truth. Robert Futrell similarly assessed that photo reconnaissance contributed little to the overall ground campaign.[63]

Lessons Learned and Improvements

Having experienced the crucible of conflict, those involved sought to capture the many important lessons gained. While most units recognized the potential for aerial reconnaissance, few had particularly positive comments regarding its employment or effectiveness. Aerial reconnaissance support to ground operations in North Africa certainly started rough, but units corrected or at least identified many of the deficiencies by the campaign's end. The lessons themselves focused on four main topics: organization, command and control, tactics and techniques, resources, and training.

Organization, Command and Control

Even before operations ended, organizational changes continued. A board met in Washington, D.C. in February 1943 to discuss observation aviation. Unfortunately, it ignored some of the North Africa experience, but it ended the mixed composition of squadrons and removed all liaison aircraft from observation squadrons in favor of liaison squadrons working directly for ground units. A separate decision in April redesignated all observation units as tactical reconnaissance squadrons and each reconnaissance group assumed control of two reconnaissance squadrons (fighter), one reconnaissance squadron (bombardment), and one liaison squadron.[64]

Concerning tactical air employment, the AAF learned that "the use of air forces in small packets is as disastrous in the battle area as it may be in the great world-wide picture."[65] The Northwest African Air Force Commander, Lieutenant General Spaatz, expressed to the Command and General Staff School Commandant, Major General Karl Truesdell, his dissatisfaction with the mixed nature of observation groups with multiple aircraft types, the decentralized structure of units that left some "too small to realize their full effectiveness," and unproductive liaison aircraft.[66] Problems started when reconnaissance aircraft attached to one unit were insufficient to meet the requirements, or worse when aircraft remained idle despite requirements in other areas. Difficulties also arose when coordinating observation and fighter escort missions. To correct these real and perceived command and control problems, the Army Air Force centralized control of tactical air power and renamed the air support commands the tactical air divisions.[67]

The evolution continued with June 1943 board that included Lieutenant Colonel John Dyas, the 154th's commander, among others with North Africa experience to examine aerial reconnaissance. The board concluded reconnaissance essentially comprised two areas: strategic and tactical missions. To support the latter, tactical air forces needed a group with tactical and photo reconnaissance squadrons to support tactical air and ground force units. Tactical reconnaissance squadrons would support ground forces with visual reconnaissance as the main mission and photographic capabilities as a secondary capability. It would also maintain a limited photo print production capability and remain highly mobile to support ground forces. The photo squadron satisfied the photo requirements for ground units beyond the capacity or ability

of the tactical reconnaissance units; however, they also provided photo reconnaissance support to the tactical air arm in the form of targeting and bomb damage assessments.[68]

Several other major changes affected reconnaissance units during this period that represented a concerted effort to improve the performance of reconnaissance assets. First, observation and reconnaissance units had to employ aircraft capable of matching or beating the best enemy aircraft available; this necessitated the use of fast fighters. Photographic units stayed with sixteen F-5s per squadron, while the TRS began transitioning to F-6s (P-51s), eighteen per squadron, to reduce the requirement for escort fighters. With the experience gained using P-39s, the XII ASC strongly endorsed the P-51 as suitable for visual reconnaissance. Despite the authorized numbers, heavy losses among combat fighter units later forced modifications to the program outlined.[69]

Tactics, Techniques and Procedures

Those managing collection requirements drew many of the same conclusions concerning control. Many airmen realized aerial reconnaissance allocation needed greater centralization due to the continued increase in photo requests and the duplication between AAF and RAF assets. They viewed a governing board as the solution. After several conferences, they created the Mediterranean Photo Intelligence Center composed of American and British air, navy, and ground personnel with the following tasks:

1. Coordinate and determine photo intelligence priorities within the Mediterranean Theater of Operations (MTO)

2. Coordinate distribution of photo reports in the MTO and neighboring theaters

For unknown reasons, the organization did not formally stand up until February 1944; therefore, many of the problems persisted.[70]

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Many organizations identified lessons relating to aerial reconnaissance, but the Allied Force HQ (AFHQ) provided the most comprehensive review concerning tactics and techniques. It compiled initial lessons from the Eastern, Central, and Western Task Forces (TF) in a 19 January 1943, draft report. The Eastern Task Force had adequate photographic coverage, but recommended increasing the availability of prints and interpreters. The Central force remained noticeably silent on photo reconnaissance, but its 1st Infantry Division identified the dearth of aerial photos of enemy positions as a hindrance to its artillery fire. It also found the system for requesting and receiving air support "too cumbersome and too slow" due to too many higher echelons. While Air Liaison Officers provided great assistance, the division only briefly had one. The Western Task Force echoed many of the previous comments, but added that photos be distributed to the company level and recognized the need for centralization to reduce duplication. Its 2d Armored Division requested greater inland coverage during an amphibious invasion to aid follow-on operations since "in the early stages, no ground reconnaissance is available for anything beyond a few miles of the beach."[71] Interestingly, one finding became a major point in the post war recommendations, the need for the Army to have the resources for mass reproduction under its control.[72]

A separate AFHQ G-2 report issued in March 1943 reiterated many of the same comments, but in some cases offered its own perspective. The G-2 valued the stereo coverage, interpretation reports, annotated mosaics, terrain models, and comparative coverage; collectively they greatly aided planning efforts. The products were widely disseminated, but many recipients appeared to lack the training to utilize them. Not surprisingly, the report recommended not distributing photos below the brigade level

"except in special cases."[73] In addition to the training deficiencies identified, it likely represented a perceived risk that the photos could cause more problems than they solved in the wrong hands. The army, corps, and armored divisions needed more ALOs to coordinate better reconnaissance missions for the aircraft it did have. Lastly, the report found lithographic prints of photos lost too much detail and recommended instead the use of photo mosaics or over-printing enemy activity on maps. The former showed the truest representation, but the maps were easier to mass-produce.[74]

Regarding photo interpretation, several other lessons became evident. Interpreters assigned to an army echelon should be self-contained and fully mobile to keep pace with the HQ as it moved, but it described Army Air Force trailers in use as "too big and unwieldy."[75] Photo interpreters were in short supply and only frequent periods of bad weather kept from exhausting the force. As for the art of interpretation itself, units found great value in fusing other intelligence sources with photos. The report recommended this occur at the division level where it would be closest to prisoner interrogations and reporting from reconnaissance patrols; yet the divisions lacked the personnel to make it work effectively.[76] The AFHQ G-2 later suggested that counter-battery officers "should live with the interpretation section," as a recognition of its importance to that mission.[77]

Following the Axis collapse in Tunisia, G-2s from U.S. units in North Africa including the Fifth Army and the corps and divisions held a conference at AFHQ during 23-26 May 1943.[78] The discussions focused on exchanging experience for the benefit of newer G-2s, determining training focus areas, and providing information on the overall intelligence effort in theater. Concerning aerial reconnaissance, "all G-2's who had been in action in Tunisia stated that the supply of maps and aerial photos during the recent

campaign was entirely inadequate."[79] Lieutenant Colonel Porter, 1st Division's G-2,

found the liaison planes provided better reconnaissance than the AAF and raised concerns

about the shortage of night aerial reconnaissance.[80] Brigadier General Sir Kenneth W. D.

Strong, RAF, the Allied Force HQ G-2, underscored the importance of aerial photographs

and assured the group "that every effort was being made to overcome the present

shortage in the air corps of photographic planes, equipment, and personnel," and that he

planned to have an army photo interpretation unit at each corps.[81] His comments point to

the slow progress made since November 1942. The conference discussion notes may not

have captured everything, but one would have expected greater detail on aerial

reconnaissance given its perceived importance. Of the twenty-nine pages, slightly more

than a page focused on the subject and the subject did not make the final

recommendations. It simply reflected an acknowledgement that little could be done at

their level and therefore they spent their time on other issues.

True to his word, Brigadier General Strong pushed for greater theater Army Air

Force aerial reconnaissance presence and improvements with a detailed report in late July

1943 to the War Department G-2 among others. While explicitly avoiding the more

contentious issue of Army versus AAF control, he partially changed his earlier position

on decentralization and recommended "all photographic resources must be centralised

and under one control."[82] Centralization permitted efficient coordination between service

representatives. To aid synchronization, the report recommended the creation of G (Air)

sections at the army and corps levels to validate and prioritize the requirements for their

subordinate units before submitting them to a joint staff for approval.[83] These G (Air)

sections became the G-2 (Air) and G-3 (Air) that existed in later operations.

Centralization most aptly applied to the early planning stages, but changed once detailed planning and execution occurred. Spreading assets too thinly at lower echelons caused duplication and coordination problems, yet Army leaders favored self-contained, mobile detachments operating with each field army. Additionally, each corps should have an interpreter and each division two when possible. Detachments needed ALOs to receive requests, brief pilots, ensure coverage occurred or re-order as needed, maintain awareness of the ground situation, and educate ground units.[84] This dichotomy existed in varying degrees throughout the war as centralization promoted great efficiency while detachments favored greater responsiveness. In the end, they compromised with centralization to a point, but still retaining units attached to field armies.

<center>Resources</center>

Resource shortages included everything from aircraft and interpreters to print paper and thirty-six-inch focal length cameras. Clearly, the theaters need more reconnaissance assets to handle the requests by all forces. Various rules of thumb developed including approximately thirty photo reconnaissance aircraft for every 100 miles of front or one reconnaissance squadron per corps, but the point remained that insufficient aircraft existed. Based on the second forward unit experience, the Allied Force HQ recommended a minimum of six operational aircraft to support an army of two corps. This required a full squadron to allow for maintenance and losses. Therefore, one photo group could not handle all of the requirements for the air, navy, and ground units. Due to wide variances in the requests for photo materials during the planning stages, the Allied Force HQ recommended standardizing the set of materials to ease the associated

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resource and dissemination problems. Even the report authors agreed the disparity grew

from differences in knowledge of photo reports and products.[85]

Training

Of no real surprise, the continued photo interpreter shortage meant units

photographed more targets than they exploited. The shortfall became so severe, that by

the summer NAPRW tasked the Major Tyler's detachment to develop a photo

intelligence training school for officers.[86] The school must have demonstrated success

and the demand for remained because the school continued well into operations in Italy.

Few people truly understood the technical aspects of photography; therefore,

trained personnel were essential to not only photograph, develop, and interpret images,

but also to assist users in developing photo requirements. Practical experience showed it

required four to six months to train a good interpreter. Training deficiencies in general

caused some to suggest training personnel from all arms, not strictly the intelligence

branch, to get a better cross-section of operational experience. The 1st Infantry Division

G-2, Lieutenant Colonel Curtiss, suggested using engineers to better understand enemy

defensive works.[87] The concept being that someone who understood field operations of a

particular discipline such as engineering, artillery, or infantry would know better the key

indicators to look for within a photo. This idea had merits and eventually caused the

inclusion of officers with engineering and artillery experience into interpretation cells.

Finally, observation units required greater emphasis during training on

reconnaissance as the primary mission since too many viewed it as secondary to being a

fighter pilot. G-2s reported regular inaccuracies with ground patrols and their organic

liaison aircraft observers. Personnel had a tendency initially to exaggerate enemy

activity, or had a difficulties identifying enemy equipment.[88] It is safe to assume pilots faced similar troubles until they gained experience.

While not a direct result of the North African campaign, at least four measures collectively helped alleviate the training problems and over the long-term produced much better personnel deployed to all theaters. First, the lessons learned themselves received wide distribution throughout the Army for inclusion in doctrine and training as necessary. Similarly, a series of conferences also developed to discuss critical subjects. These forums such as the Conference on Landing Assaults held 24 May to 23 June 1943 provided a venue for technical experts with combat experience to discuss planning and execution factors that affected aerial reconnaissance.[89] Similar to the lessons learned, their summary reports received wide dissemination.

Next, Army and Army Air Force headquarters organizations regularly sent observers forward to combat units to assist in development of policy, doctrine, training, and resource allocation. Though it is unknown when this program officially began, research for this thesis uncovered observer reports from North Africa as early as January 1943.[90] As part of standard distribution, many army, corps, command, and training center organizations received these reports.

Beyond formally sending observers, the U.S. Army's Command and General Staff School (CGSS) routinely submitted requests to operational units for information to keep its curriculum current. As early as 19 March 1943, the school's commandant, Major General Karl Truesdell, requested and received information from Spaatz on a variety of AAF related subjects including aerial reconnaissance.[91] This infusion of operational information into the courses helped provide realism and served to train some

of the officer corps on the area of operations and adversary they would soon face. This pattern continued throughout the war with a regular flow of classified information on current operations back to CGSS to train Army and Army Air Force officers.

Third, the Army Air Force made a regular effort of recycling combat experience into reconnaissance training units in the United States. One of the earliest such moves occurred when Colonel Frank Dunn, Lieutenant Colonel George McDonald, and Majors Humbrecht and Boyle returned after their extended experience with the 3d Group. The first two took over training at Will Rogers Field, Oklahoma in late 1943. While these moves created disruptions in the combat units and even sparked severe criticism, the long-term benefits to future reconnaissance pilots certainly overshadowed the short-term loss of those individuals. Moreover, at least four others followed including Lieutenant Colonel Leon Gray, Major Tyler, and Captains Scalpone and Russell York, which seemed to demonstrate satisfaction with this method. By the spring 1944, over 50 percent of the photo reconnaissance instructors at Will Rogers had combat experience.[92]

Finally, compared to 1941 and 1942, reconnaissance training made significant strides as summarized at the war's end, "The inadequacies of the observation units sent overseas in 1942 had been so apparent during the North African campaign that observation training was radically reorganized during the summer of 1943 on the basis of [the] British example."[93] The limited successes of operations in North Africa and the reorganization of observation units in the summer of 1943 combined with a better understanding of the intelligence needs of combat units resulted in greater emphasis on resourcing reconnaissance units. In fact, the reconnaissance units became second priority for aircraft fills only behind bombardment units.[94]

Aerial reconnaissance training also received increased focus on the content. Lieutenant Colonel Dyas visited the Army Air Force HQ with Lieutenant Colonel Edward Siden, South African Air Force, to assist in patterning U.S. training on the British model. The new plan scrapped the existing observation structure and aircraft types in favor of tactical reconnaissance based on fighter type aircraft, notably the F-6. Training length also increased from two months by early 1944 to three months by September 1944. The added length allowed greater training depth and expansion of areas not previously covered. Criticisms of photo reconnaissance training during 1942 and 1943 including training of basic photography, particularly mapping, instrument flying and equipment knowledge all received increased focus. Tactical reconnaissance training emphasized these and added training on adjusting artillery fire.[95]

British experience continued to influence interpreter training as well. During the summer of 1943, an Army group of fifteen officers and seventeen enlisted worked with British Army photo interpreters to exchange knowledge and learn their techniques. The group known as the Home Forces Intelligence Detachment later became the Photo Intelligence Center in May 1944 and was tasked to train photographic interpretation teams arriving from the United States with "practical experience."[96] These teams later served with the armies, corps, and divisions throughout Europe.

Conclusion

In many ways, North Africa became the defining experience for the Army Air Force and truly set the stage for the future successes in Italy, France, and Germany. The failures of aerial reconnaissance in support of ground operations in North Africa largely stemmed from years of inattention due to other priorities. The Army Air Force and Army

compromised on the centralization versus decentralization argument that played out in later campaigns. They also realized visual and photo reconnaissance complemented each other by balancing accuracy with timeliness. Finally, both had not anticipated the significant requirement for photo print production, its distribution, and the burden it placed on reconnaissance units.[97] Reconnaissance units responded to the challenge and did the best they could with the cards they received, but the Axis threat would not abate and aerial reconnaissance had to be more effective.

Although slow to develop, aerial reconnaissance training incorporated many of the lessons from North Africa and surmounted most of its earlier problems by 1944. That it did so while playing a secondary role to combat units is telling, and marked the gradual realization of the important role aerial reconnaissance played. By far, the most important factors leading to training improvements were overseas experience from returning personnel, greater numbers of aircraft available, and greater length of training.

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[1]Charles Anderson, *Algeria-French Morocco* (Washington, DC: U.S. Army Center of Military History, 1993), http://www.history.army.mil/brochures/algeria/algeria. htm (accessed 26 March 2009), 3-7, 28; Charles Anderson, *Tunisia* (Washington, DC: U.S. Army Center of Military History, 1993), http://www.history.army.mil/brochures/ tunisia/tunisia.htm (accessed 26 March 2009), 4.

[2]Anderson, *Tunisia*, 5, 12-13, 16-17, 24.

[3]Futrell, *Command of Observation Aviation*, 22.

[4]Boyle, 623.

[5]In fact, sixteen 68th Observation Group members died on D-day when their barge capsized. Heiman, 97; Futrell, *Command of Observation Aviation*, 22; Boyle, 83.

[6]The 12th PRS was briefly attached to the 68th Group in late 1942 until it could regroup with the 3d Photo Group. Boyle, 87-88.

[7]The Group flew seventy-nine missions by the end of December 1942, but it is unknown how many supported ground operations. Boyle, 118.

[8]Futrell, *Command of Observation Aviation*, 22; Boyle, 12, 44, 90, 153, 308.

[9]Elliot Roosevelt was the son of President Franklin D. Roosevelt.

[10]Boyle, 15, 111-112, 501.

[11]Depending on the source, NAPRW stands for North African Photographic Reconnaissance Wing or Northwest African Photographic Reconnaissance Wing.

[12]Boyle, 118, 129; Futrell, *Command of Observation Aviation*, 24.

[13]Major Robert Boyle and Lieutenant Ludovic Zupanzic later helped compile the 3d Photo Group history through September 1943. After returning to the U.S. in early 1944, he continued compiling the unit's history as part of maintaining friendships and his duty as the Historical Officer, 2d Photo Reconnaissance Group. Boyle, iii, 2.

[14]Ibid., 2.

[15]Ibid., 529.

[16]Ibid., 118, 149, 151, 156, 159, 529.

[17]Ibid., 352; Headquarters, XII Air Support Command, *Report on Operations Conducted by XII Air Support Command, United States Army Air Force, Tunisia, 13 January 1943 - 9 April 1943* (1943), 3, 5, 8, 11.

[18]Boyle, 153, 348-349, 353, 355; Heiman, 97

[19]Boyle, 335.

[20]Through trial and error, maintenance crews and pilots increased engine life from 130 to 350 hours. Dust created significant problems on engine performance that continually required attention to the air filters. Pilots likewise realized that lower power settings at higher altitudes increased the engine life and aircraft range.

[21]Boyle, 352-353, 356, 374-375.

[22]Ibid., 128.

[23]Ibid., 358.

[24]Headquarters, Northwest African Air Forces, A-3, *Operations Bulletin No. 1 for Period Ending 30 April 1943* (1943), 5.

[25]Allied Force Headquarters, Office of Assistant Chief of Staff, G-2, *Summary of Discussions: Conference of G-2's of U.S. Army in North Africa* (1943), 15, 17.

[26]Headquarters, XII Air Support Command, 1-2.

[27]Headquarters, XII Air Support Command, 12; Frank Crate and Wesley Craven, *The Army Air Forces in World War II*, vol. 2 of *Europe TORCH to POINTBLANK* (Chicago: University of Chicago Press, 1949), 169; Jerry Scutts, *Mustang Aces of the Ninth and Fifteenth Air Forces & the RAF* (London, Osprey Aerospace, 1995), 52.

[28]Army Air Force Historical Office, *The Twelfth Air Force in the North African Winter Campaign* (Army Air Force Historical Office: 1946), 186-187.

[29]Crate and Craven, vol. 2, 139-140, 169; Futrell, *Command of Observation Aviation*, 23; Headquarters, XII Air Support Command, 3, 6, 8.

[30]Headquarters, Army Ground Forces, *Observer Report* (1943), Section II, 3.

[31]Boyle, 563; Headquarters, Army Ground Forces, *Observer Report*, Section II, 3.

[32]Headquarters, Army Ground Forces, *Observer Report*, Section II, 3.

[33]Allied Force Headquarters, Office of Assistant Chief of Staff, G-2, *Production of Photographic Intelligence in a Theater During Active Operations* (1943), 2.

[34]Headquarters, Army Ground Forces, *Observer Report*, Section II, 3; Infield, 76; Crate and Craven, vol. 2, 169.

[35]Headquarters, Ninth Infantry Division, *Report on Operation Conducted by 9th Infantry Division, United States Army, Southern Tunisia, 26 March - 8 April 1943* (1943), Annex, 2.

[36]Headquarters, Ninth Infantry Division, Section II, 2-3 and Annex, 2, 5.

[37]Ibid., Annex, 7.

[38]Kreis, 163.

[39]Infield, 76.

[40]The figure thirteen percent in the "June 1943" column corrects a likely error in the source. The source has 1.3 percent, but whereas all of the other columns add to 100 percent, this one does not if 1.3 percent is used, but does when thirteen percent is utilized.

[41]Boyle, 158-160, 617, 619; Allied Force Headquarters, *Production of Photographic Intelligence*, Appendix C.

[42]Allied Force Headquarters, *Production of Photographic*, Appendix C, 2.

[43]Boyle, 356, 522.

[44]Ibid., 344-346.

[45]Headquarters, XII Air Support Command, 11-12; Headquarters, Northwest African Air Forces, A-3, 6

[46]Boyle, 564, 627.

[47]Infield, 71, 75.

[48]Boyle, 128-129, 628.

[49]Ibid., 446; Allied Force Headquarters, *Production of Photographic Intelligence*, 3, Appendix C, 1.

[50]Boyle, 3-4.

[51]Ibid., 336.

[52]Libraries maintained photos for current or future campaigns, but frequently discarded those from previous campaigns. Ibid., 337, 339, 341-342, 564, 594, 597.

[53]Ibid., 624.

[54]Ibid., 97, 106, 312, 314, 337-338.

[55]Ibid., 337, 343, 624.

[56]Ibid., 588.

[57]NAPRW flew a mission per day from January and February, but from March to April and June to September, it averaged two missions per day between six locations. Headquarters, XII Air Support Command, 12; Boyle, 353, 562, 586.

[58]Boyle, 122, 564, 619.

[59]Ibid., 120; Headquarters, XII Air Support Command, 3, 6, 8.

[60]Boyle, 17.

[61]Allied Force Headquarters, Intelligence Training Center, *Outline No. 25: Lower Echelon Intelligence* (1943), 19.

[62]Oscar Koch, *G-2: Intelligence for Patton* (Atglen, PA: Schiffer Military History, 1999), 32.

[63]Futrell, *Command of Observation Aviation*, 23.

[64]Ibid., 24-25.

[65]Ibid., 23.

[66]Lieutenant General Carl Spaatz, *Memo to Commandant, Command and General Staff School* (1943), 4.

[67]Futrell, *Command of Observation Aviation*, 23.

[68]Ibid., 25-26.

[69]Futrell, *Command of Observation Aviation*, 23, 27-28; Headquarters, XII Air Support Command, 12.

[70]Mediterranean Allied Air Force, *The Evolution of MAAF Intelligence* (1945), Chapter VIII, 1.

[71]Headquarters, Second Armored Division. *Memo from Second Armored Division: Lessons from Operation TORCH* (1942), 1-2.

[72]Allied Force Headquarters. *Staff Memorandum #7: Lessons of Operation Torch* (1943), 6, 24, 28, 39, 41.

[73]Allied Force Headquarters, Office of Assistant Chief of Staff, G-2, *Intelligence Lessons from North Africa: Operation "Torch" up to 1st March 1943* (1943), 4.

[74]The models themselves were derived from photo intelligence and other sources, and built by Engineering Topographical Units. Ibid., 3-5, 7.

[75]Ibid., 6.

[76]Ibid.

[77]Allied Force Headquarters, *Production of Photographic Intelligence*, Appendix C, 2.

[78]The G-2s represented the following units: Fifth Army, I Armored Corps, I and VI Corps, 2d Armored Division, 82d Airborne Division, and 1st, 3d, 9th, 34th, 36th, and 45th Infantry Divisions. Allied Force Headquarters, *Summary of Discussions*, 1.

[79]Ibid., 2.

[80]Lieutenant Colonel Porter's first name is unknown.

[81]Ibid., 6, 8.

[82]Allied Force Headquarters, *Intelligence Lessons from North Africa*, 6; Allied Force Headquarters, *Production of Photographic Intelligence*, 1.

[83] Allied Force Headquarters, *Production of Photographic Intelligence*, Appendix B.

[84] Ibid., 1,3, Appendix D, 3.

[85] Ibid., 1-2, Appendix D, 1; Futrell, *Command of Observation Aviation*, 24; Allied Force Headquarters, *Intelligence Lessons from North Africa*, 6.

[86] Infield, 75; Boyle, 622, 625.

[87] Lieutenant Colonel Curtiss' first name is unknown. War Department, Air Corps Field Manual 1-35, 21-22; Allied Force Headquarters, *Production of Photographic Intelligence*, 2-3; Allied Force Headquarters, *Summary of Discussions*, 11.

[88] Center for Air Force History, *The AAF in Northwest Africa* (Washington, DC: Center for Air Force History, 1992), 66; Allied Force Headquarters, *Summary of Discussions* (1943), 8-9.

[89] U.S. Assault Training Center, European Theater of Operations, *Conference on Landing Assaults: 24 May--23 June 1943* (1943).

[90] Headquarters, Army Ground Forces, *Observer Report*, Cover Letter.

[91] Major General Karl Truesdell, *Memo to Commanding General, Twelfth Air Force* (19 March 1943), 1.

[92] Boyle, iii, 399, 451, 505, 611, 623, 627, 633; Air Historical Office, *Army Air Forces Historical Studies: No 61*, 85.

[93] Air Historical Office, *Army Air Forces Historical Studies: No 61*, 82.

[94] Ibid., 81.

[95] Ibid., 83-86.

[96] The teams consisted of two officers and four enlisted personnel. The General Board, United States Forces, European Theater, *Military Intelligence Service*, 13, 15.

[97] Boyle, 17.

CHAPTER 4

SICILY: APPLYING THE LESSONS

Overview

In January 1943, American and British political and military leaders decided to invade Sicily after North Africa as a stepping-stone to Italy itself. Invasion planning started immediately afterward. The invasion, named Operation HUSKY, involved the Western Task Force (TF), known as TF 343, with all American units, and an Eastern TF of the British Eighth Army under General Sir Bernard Montgomery. The TF 343 ground component later became the Seventh Army led by Lieutenant General George Patton. An airborne assault occurred on 9 July 1943, and amphibious invasion on 10 July of the southern coast at Scoglitti, Gela, and Licata.[1] Once ashore, the Eighth Army moved north along the east coast to Messina, meanwhile Patton's Army drove northwest to Palermo then east to Messina where the campaign ended in mid-August. (see figure 19)

Invasion Planning

Unlike Operation TORCH, aerial reconnaissance units provided much greater support to ground forces and aerial photos served as the main intelligence source during planning. Well before the invasion, the 3d Group's detachment on Malta, directly supported TF 343's planning. This unit stood up to photograph Sicily and the toe of Italy for general mapping and pinpoint target coverage, and flew its first mission on 28 March 1943. In fact, the unit provided 100 percent of Seventh Army's photo coverage, and covered the entire island, an area the size of Massachusetts, to create large mosaics.[2]
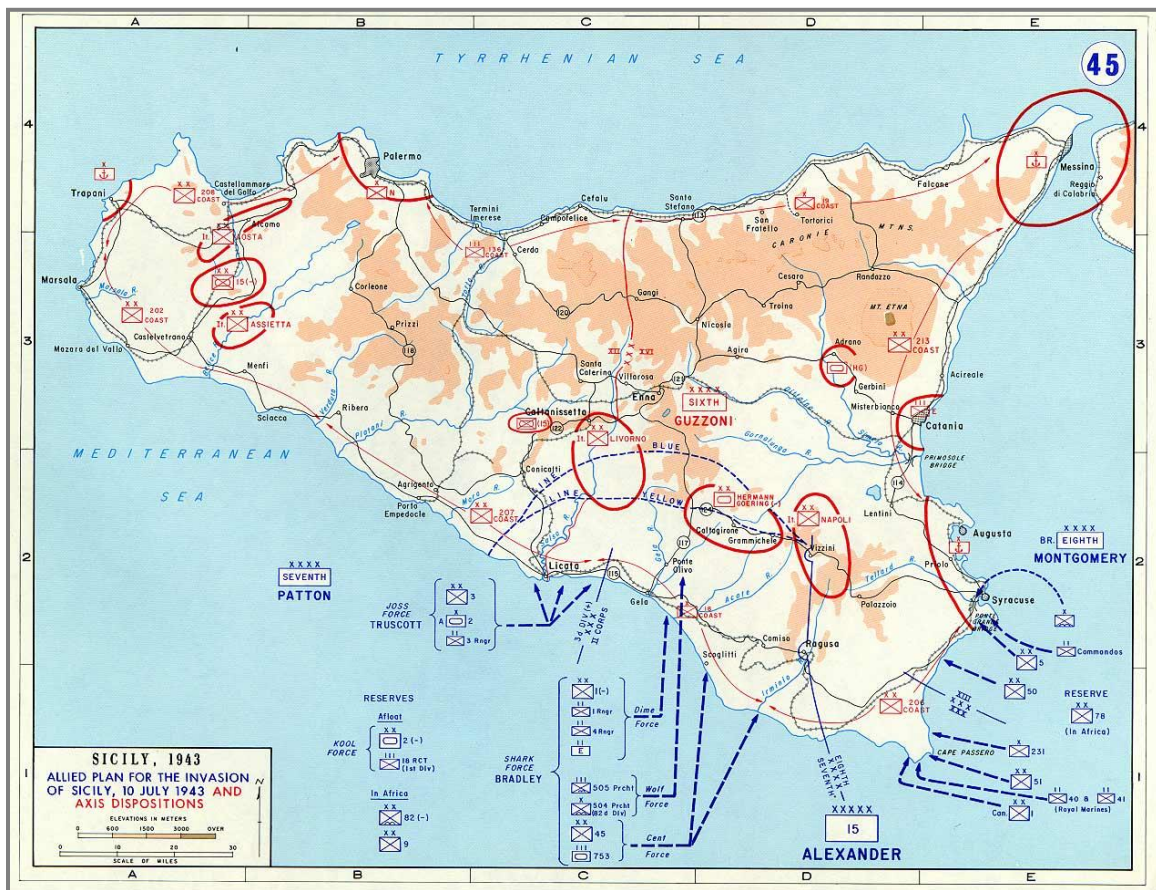
Figure 19. Operation HUSKY, Sicily, Italy, July 1943
Source: World War II, European Theater, "Campaign In Sicily, Allied Plan And Axis Dispositions, 10 July, 1943," U.S. Military Academy, http://www.dean.usma.edu/history /web03/atlases/ww2%20europe/EuropeanTheaterGIF/WWIIEurope45.gif (accessed 11 March 2009).

The basic photographic coverage plan started with area coverage of western Sicily at 1:50,000 scale. From there, selected areas received large-scale, recurring coverage at varying frequency depending on the area photographed. As the invasion neared, the frequency of coverage increased to locate and discern as much change as possible and provide possible indications of German knowledge of the invasion. (see figure 20) Planners also requested 1:18,000 scale coverage of roads and railroads. From these

photos, TF 343 planners needed mosaics of all landing beaches, cities, airfields, and drop

zones and objectives for the airborne troops, and a 1:5,000 relief model of the beaches.[3]
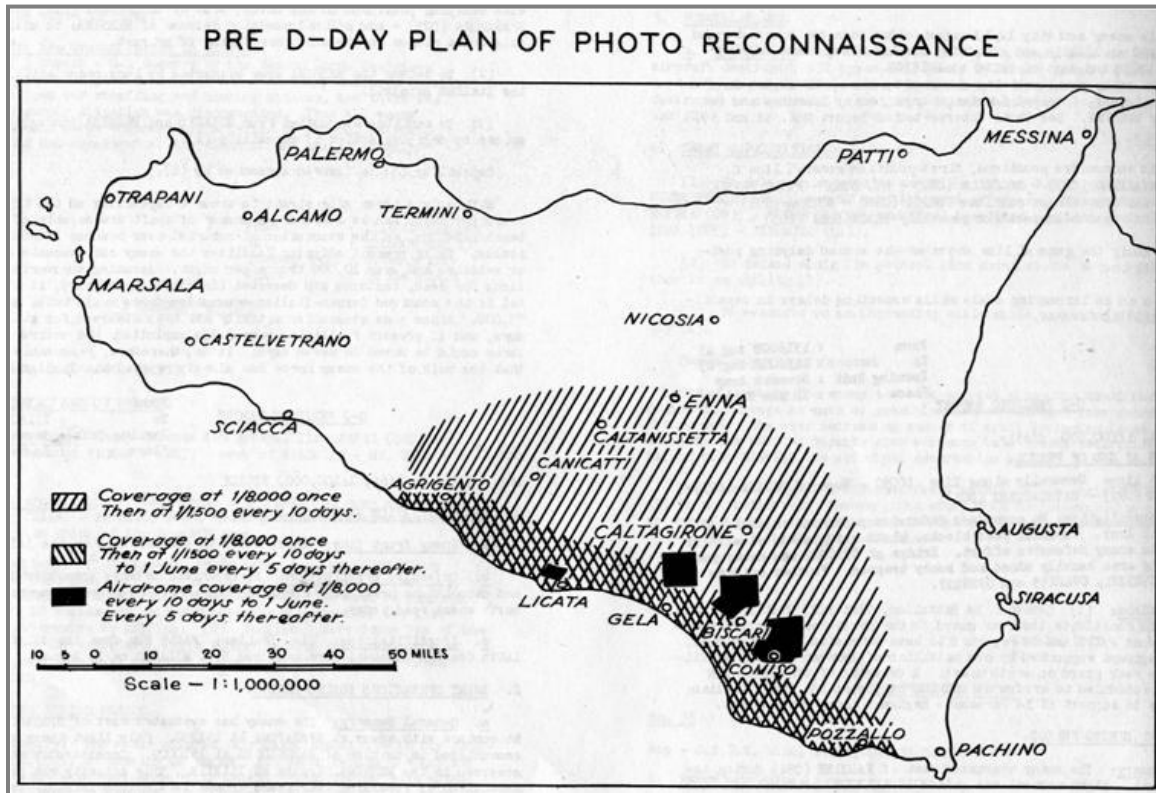
Figure 20. Operation HUSKY Pre D-Day Photo Reconnaissance Coverage
Source: Seventh Army Staff, *The Seventh Army in Sicily* (Seventh Army Staff: 1943),
Part II, C-45, Annex 7.

These requirements needed many missions to complete and required great skill to

cover the entire area in roughly the same scale to ensure the photos properly matched at

key geographic points to build the mosaics. Once again, British reconnaissance units on

Malta provided invaluable assistance on enemy fighter locations, weather conditions,

navigation aids, and flight de-confliction. The short distance to Sicily, sixty miles at the

closet point, reduced the concern over fuel consumption and permitted pilots to fly at faster speeds to lower the threat of interception. Another tactic used radios to contact British radar stations to avoid enemy fighter patrols or report "fat" targets for attack.[4]

Despite repeated II Corps requests for night reconnaissance in North Africa, no operational capability existed until Sicily. In mid-July 1943, Lieutenant General Carl Spaatz directed the Northwest African Photographic Reconnaissance Wing (NAPRW) "to organize and operate night photographic facilities for the Sicilian battle."[5] Night photos offered a new capability; however, given the nighttime navigational difficulties of the period, pilots needed pinpoint targets rather than wide area coverage. Photo taskings confirmed this limitation since road junctions comprised all five D-day targets and the nine targets through D+4. Another technique involved using night reconnaissance to cover targets with any shift in forces identified from the late afternoon missions.[6]

In addition to ground forces, NAPRW supported many units with its scarce resources. As operations in North Africa neared the end, many reconnaissance efforts shifted to Sicily and Italy. British Squadron Leader E. Mitting stated that NAPRW focused much of its attention on enemy air and naval forces until the invasion of Italy. Until resistance ended, this support required twice per day coverage of twenty-six major airfields and twice per day coverage of Sicilian ports and the Messina Strait to search for German reinforcements. Moreover, once per week, photo aircraft covered these and other airfields within a four-hour window to give the most accurate count of aircraft in theater.[7] Collectively, this and many other taskings explain why the Army received only 18 percent of the photographic coverage in June 1943. (see table 1)

For photo interpretation, the Seventh Army started with one officer in March, but expanded by D-day to thirty-five officers and seventy enlisted men with the addition of NAPRW personnel, including thirteen interpreters. By 1 June, they formally became the Seventh Army Photo Interpretation Detachment (APID) and assumed primary interpretation responsibility from the Fifteenth Army Group for Sicily ground operations related planning. Located at the La Marsa, Tunisia airfield, the unit provided Army expertise to work with 3d Group interpreters. In addition to the interpreters, the unit eventually included a photo lab, the 66th Topograhic Company, an artillery officer for counter-battery targeting, and ten F-5s and supporting crews from the 12th Photo Squadron.[8] Then Major Charles H. Bonesteel III even had a few of his engineers trained to assist interpreters in determining whether bridges had demolition charges. Though not perfect, it did allow engineering units to better anticipate potential repairs and bridging assets needed. Seventh Army subsequently detached six interpreters from the photo detachment, enough to field one per division and one at II Corps.[9]

Interpreters distributed intelligence on enemy positions via over-printed maps and eighteen text reports. These reports described in detail the artillery batteries, supply dumps, minefields and anti-tank ditches located on photos. Fifteenth Army Group disseminated 200 copies of the first over-printed maps on 19 May, while Seventh Army completed 1,900 copies of the second edition that covered the army's area of operations. On D-10, the 66th Topographical Company joined the photo detachment to increase the timeliness and accuracy of these maps. Subsequently, the 62d Topographical Company performed the same service once units moved to Sicily, but separation from the APID caused a significant lose of time. To assist interpreters after the invasion, Task Force 343

planners intended to give interpreters updated information on the operational situation and focused areas to exploit rather than area searches; both of which intended to keep timelines to an average of six hours from request to broadcast.[10]

Photo intelligence had mixed effect during planning, depending on the unit. It contributed to the major intelligence estimates used for planning with details on troop disposition and strength, locations of artillery for targeting purposes, and secondary defensive positions. When analyzed with German transport capabilities and the roads, analysts estimated how quickly units could reinforce the beaches. Reports derived from photos of the beaches included the following: estimated beach gradient, on and offshore obstacles, and details concerning all observed defensive and nearby artillery positions that could fire on the beach.[11] Colonel Koch, the Seventh Army G-2, concluded, "our intelligence preceding the invasion had been good and accurate."[12]

One definite bright spot came in the form of terrain models. According to Colonel Koch, "An important innovation in the planning for Sicily involved our use of relief terrain models."[13] Model making involved two basic methods, photo-skin, and egg-crate. The former used hardboard cutouts of terrain contours covered in plaster with photos stretched over the resulting model; paint and building models helped pull out additional details. When illuminated to produce realistic sun light conditions, the models were photographed from different angles and the resulting photos disseminated to ground units. The egg-crate models used a smaller scale and consequently provided less detail, but they were produced faster. Both methods depended heavily on aerial photos and maps to build. Model builders constructed a 1:25,000 scale model of the southern third of Sicily. The final product took two months to build and included "ten sections, each

measuring 14 feet by 16 feet."[14] Based on the success of these models, a model-making

detachment later served with the Fifth Army throughout the Italian campaign.[15]

The 3d Group's fourth forward unit at Oujda, Algeria also supported Operation

HUSKY. This unit, along with several French pilots and other personnel, started

operations in early May in support of paradrop training by the 82d Airborne Division.

Essentially the unit served to locate suitable drop zones for practice training. By 22 May

1943, the unit had flown eighteen missions for the division and the 52d Troop Transport

Wing, while the Malta based unit continued its search for suitable operational landing

zones on Sicily. The 505th Parachute Infantry Regiment utilized aerial photos and sand

table models extensively to train personnel prior to its combat drops in Sicily. Details

included the terrain around its main objective, and roads and terrain from Caltagirone to

the coast.[16] Lieutenant General Mark Clark commented, "[NAPRW] helped to develop a

method of locating drop zones for parachute troops that has proved very successful."[17]

During the combat drops, transport pilots carried photos with them given the lack of

markers or pathfinder teams. "This seemed satisfactory, for on a previous night

reconnaissance, Colonel James Gavin found that 'all check points and terrain showed up

clearly in the moonlight, exactly as we had memorized them from photographs.'"[18]

One of the main ground force elements for the operation, the JOSS[19] Task Force,

composed of the 3d Division and attached 2d Armored Division units, started planning in

early April with a focus on terrain and enemy defenses. Aerial photos and British

topography studies provided the bulk of the information used; in fact, photos provided

"practically all the information on fixed defenses" and helped confirm beach topographic

surveys.[20] Photos furnished invaluable details such as beach sizes and exits, height of

obstructions, movement corridors, and likely arcs of fire and weaknesses of defensive positions. In particular, planners valued oblique images taken of the beaches and foothills. Even so, planners quickly identified some important shortcomings. Despite repeated requests as early as D-60, the task force lacked aviation representation and later criticized it as a serious impediment to planning air support, reconnaissance included.[21] Moreover, aerial photos frequently arrived late as evidenced, "Had the necessary planning been dependent on aerial photos and interpretations furnished thru regular channels it would have seriously delayed the proper planning."[22] Naval planners had similar complaints about an oblique sortie around D-15 that arrived "too late for the information which they revealed to be incorporated in the panoramic beach sketches."[23]

The situation improved slightly when the JOSS Task Force received an Army Air Force interpreter and planners resorted to unofficial channels for photo requests.[24] The interpreter arrived late in the planning cycle, therefore his services only "brought about small changes in the initial outline plan" built in May.[25] Even so, that statement does not easily reconcile with other comments in the same report. Planners faced a problem determining the feasibility of Red Beach to accommodate a regimental combat team, a maneuver strongly desired. Only the "careful study from aerial photographs . . . made by the interpreter" resolved the issue in favor of Red Beach.[26] The report also indicated "the tactical plan of each [3d Division] unit was mainly based upon, or considerably influenced by the information extracted from the air photographs. A ground check after landing revealed this type of information as being extremely accurate."[27]

While some small-scale coverage existed, large-scale coverage remained problematic. The dearth of suitable photos forced the task force commander, Major

General Lucian Truscott, to make a special request of an Army Air Force friend. Within twenty-four hours, the British flew sorties for the Army Air Force request with a thirty-six inch camera across a fifteen-mile stretch of beach. This arrangement secured information that countered earlier assessments of exits at one of the beaches. With this intelligence, Truscott divided his force between two beaches split by a river. While a riskier move due to maneuver and reinforcement problems, it presented greater opportunity to seize terrain inland. Unofficial requests like this helped get responses within forty-eight hours of the request.[28] While aerial reconnaissance did not solve every problem, it did contribute at several key points during the planning process.

Once gathered, planners created a JOSS Force information file that compiled all of the associated intelligence for the operation. This file received wide dissemination with no less than four defensive map overlays updated from 11 June to 1 July 1943, with between 150 and 200 copies distributed in each case. The JOSS Task Force received fifty mosaics alone covering the area east of Licata. While product timeliness remained an issue, planners did find the supply of photos and overprinted maps adequate.[29]

A British officer observed similar problems while at the Task Force 343 and JOSS Task Force headquarters in May and June 1943. He noted units had incomplete, small-scale coverage of the required areas in late May, but by then planners had finalized the initial plans.[30] This apparent mismatch obviated much of the value photo intelligence would have offered. For the photo-based reports it received, "interpretations supplied by the 15th Army Group often differed fundamentally from those made by the interpreter attached to JOSS Force."[31] The British Eighth Army's Captain Butler had replaced the Army Air Force interpreter, and in every case his analysis "proved to be correct."[32]

As the invasion approached, Task Force 343 implemented a number of measures to address communication and to anticipate potential problems. First, to ensure close coordination and timely intelligence, the G-2 arranged to relocate "some photo aircraft" and "some interpreters" to form forward element sometime between D+4 and D+8.[33] To facilitate this plan, the Malta detachment relocated to Ariana, Tunisia, just before the invasion and became the 12th Photo Squadron. Similarly, the 111th Tactical Reconnaissance Squadron[34] initially remained at Cape Bon, Tunisia, with the XII Air Support Command rear HQ, but planned to deploy to Sicily between D+2 and D+5.[35]

To improve the information flow between units and accommodate the uniqueness of an amphibious invasion, Task Force 343 modified the flow of information. The Fifteenth Army Group, in coordination with task force liaisons, controlled the tasking process during the planning process. During the execution phase, this transferred to Task Force 343. Units submitted requests beyond those identified by the EEIs, presumably the pre-planned missions, to the TF 343 G-2, not through the air support parties, for direct coordination with the 12th Photo Squadron. While underway, the HQ afloat compiled requirements and forwarded them to its rear command post for coordination with NAPRW. The G-2 even permitted subordinate commands to communicate directly with the rear HQ to allow flexibility, though radio line of sight limitations challenged the technical feasibility. The reconnaissance elements arranged to communicate results via radio to the forces afloat to ensure they had the latest intelligence. After the invasion started, a Seventh Army G-2 liaison officer at the 12th Photo Squadron airfield in Tunisia helped coordinate tasking requests via radio, telephone, and couriers once they

established communication on D+8. Finally, according to the Field Orders, the G-2 oversaw all tasking related to tactical reconnaissance missions.[36]

Liaisons continued to play an important role in the coordination and education process. The 13th Photo Intelligence Detachment did a commendable job in North Africa supporting ground units, so that the 2d Armored Corps, and the 1st and 3d Divisions requested continued support of their assigned officers for the Sicily invasion. Their role included briefing division and supporting commanders on all aspects of the invasion discernable from photo intelligence.[37]

For the actual invasion, TF 343 scheduled pre-planned photo reconnaissance missions for D-day through D+5. (see figure 21) The task force employed pre-planned missions in the event poor communications prevented last minute scheduling. It remains unclear if units flew these as planned, but the Seventh Army concluded the pre-planned missions "proved invaluable."[38] The task force only had four sorties available after the invasion; presumably due to competing requirements and the ability to adequately cover the area needed with that many missions. That said, the 3d Group later flew seven sorties over the beachhead on D-day. To maximize coverage time, TF 343 planned one mission after daybreak, one in the middle of the day, and a final one in the late afternoon. With no specific scale identified, the unit must have optimized the best scale based on equipment availability, anticipated threat, and the requested area. After D-day, the planned coverage area gradually expanded to cover areas toward the north and northwest for the advance on Palermo.[39]

For the 111th Tactical Reconnaissance Squadron, Task Force 343 also pre-planned missions for it through D+5 in case communication problems developed. On D-

day, it tasked the 111th with twenty-seven missions to provide dawn-to-dusk coverage for the most critical day of the operation. After that, the squadron would support nine missions of eighteen sorties per day. Ground units tasked the 111th to focus its observation on the road networks feeding the beachhead, and supplemented as necessary by low oblique photo strips "for the purpose of determining the composition, strength, and movement of enemy forces" that might interfere with the invasion.[40] The task force needed coverage of ten areas that focused exclusively on roads and junctions between major towns, with no pre-planned support to artillery adjustment or forces in contact. The G-3 must have felt confident of the intelligence they possessed on the immediate beach defenses, and clearly desired information on reinforcement movements. This plan compromised between area and spot targets as lessons from North Africa had identified. Since the tasking required reports by 1000 or 1100 each day depending on the target, it did not optimize collection for extended coverage except on D-day. Finally, the reporting requirements seemed rather vague with little more than information on the locations, equipment types, and direction and size of movements.[41] (see figure 22)

Finally, to improve the potential of these tactical reconnaissance missions, the Seventh Army used some of its armor, infantry, and artillery officers to train 111th pilots on what to look for prior to the invasion. The training provided the following:

> To assist in this training a ground school briefly covering Organization of [the] Army, formations and tactics of infantry, landing operations on hostile shores, types of invasion craft and landing boats, artillery organization, tactical employment of artillery, artillery adjustment fire, identification of armored vehicles, road space required by units in march, bivouac and deployed formations, and the capabilities of German anti-aircraft artillery.[42]

Pilots later took advantage of allied amphibious training to observe the execution of landing operations prior to the actual invasion to enhance their skills further.[43]
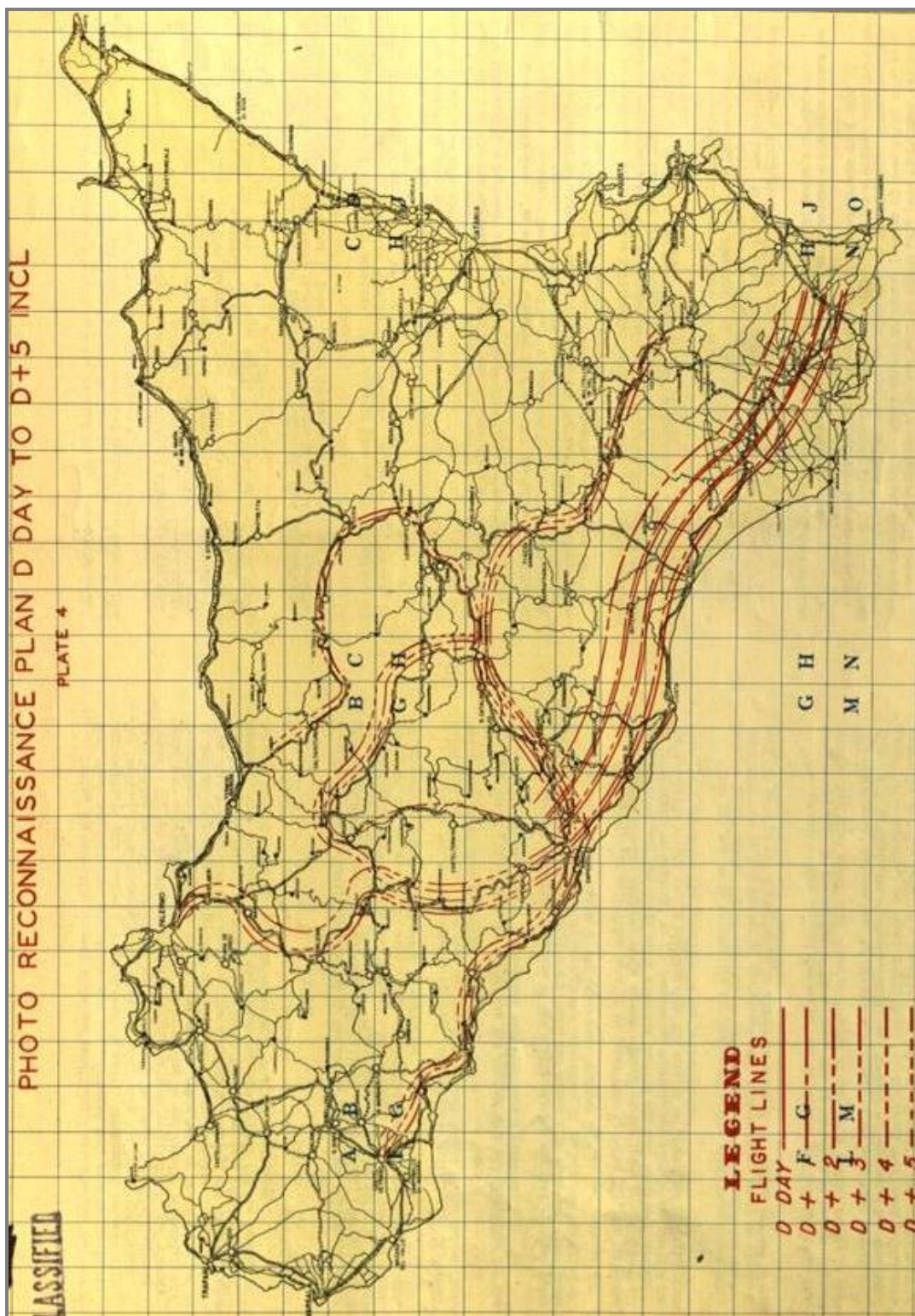
Figure 21. Operation HUSKY, Photo Reconnaissance Plan, D-Day to D+5
Source: Seventh Army Staff, *The Seventh Army in Sicily* (Seventh Army Staff: 1943),
Part I, Plate 4.
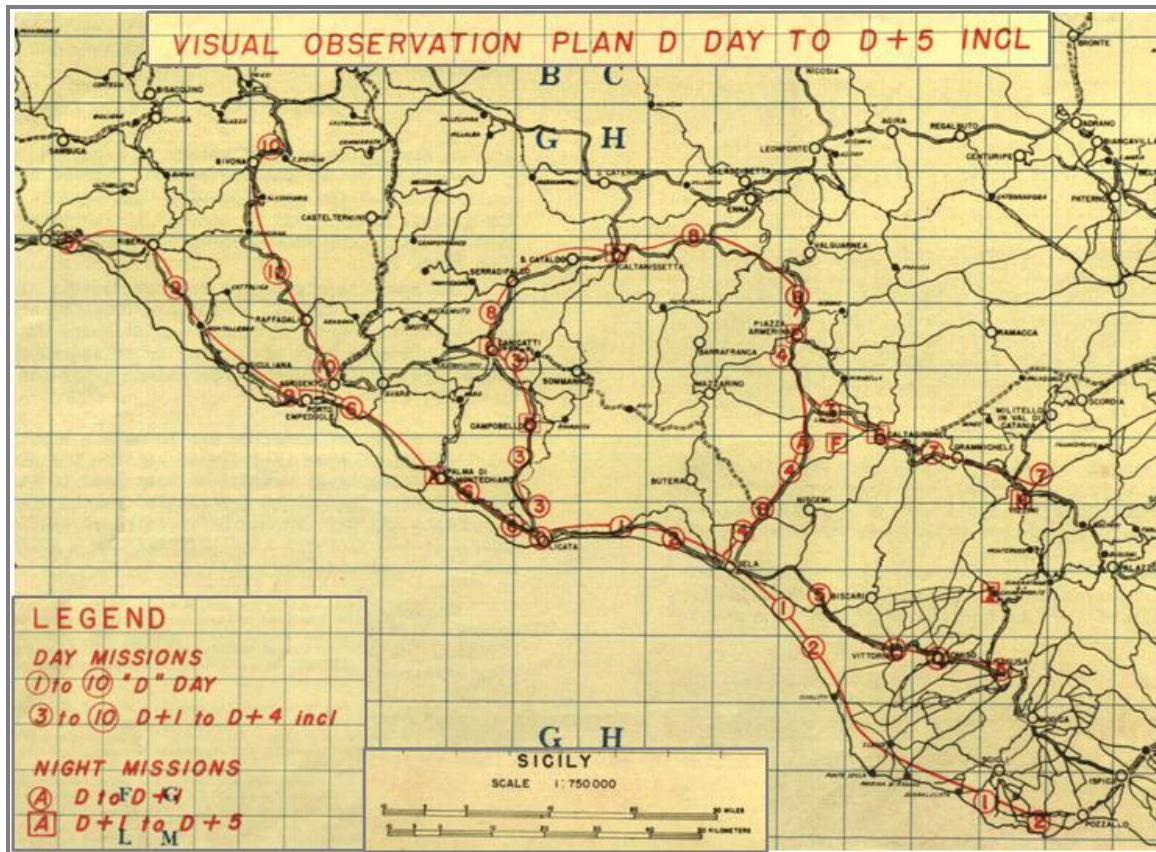
Figure 22. Operation HUSKY, Tactical Reconnaissance Plan, D-Day to D+5
Source: Seventh Army Staff, *The Seventh Army in Sicily* (Seventh Army Staff: 1943), Part I, Plate 3.

Operations

Photo Reconnaissance

Reconnaissance flights over Sicily faced their share of operational problems, though not difficult as North Africa. Terrain posed the biggest obstacle, since much of the island is mountainous with peaks averaging 2,000 to 4,500 feet and Mount Etna dominating at over 10,000 feet. Due to the July invasion and conclusion in August, the operation avoided the wet weather season of October to January.[44] Enemy air defense remained similar to North Africa with no major increase in loses over the preceding

months, possibly due to assistance from British early warning radars. Finally, aircraft troubles largely disappeared in the immediate lead up to Sicily.

The 12th Photo Squadron initially operated from Tunisia after the invasion. Interpreters sent reports from Tunisia via radio on the artillery radio net through D+10 (20 July), after which the unit conducted operations from Sicily. On D+2 (12 July), squadron ground personnel moved to Ponte Olive airfield, Sicily, on the south coast. Starting D+10, F-5 pilots from Tunisia landed there for pre-mission briefings, returned there with exposed film, completed a mission debrief, and then returned to Tunisia to reduce the risk from German air attacks. Meanwhile, personnel in Sicily stayed close to the airfield to receive a mission's film quickly, but far enough to reduce the threat of air strikes and the interruption it caused. The unit averaged five missions per day, but the limited number of personnel and equipment kept capacity at 600 prints per hour. A courier service flew twice per day to NAPRW in Tunisia for mass production.[45]

After D+10, all squadron photo production occurred on Sicily. Each sortie generated approximately 255 prints, with three sets of the prints made, one for the 12th Photo Squadron archive, and one each for the II Corps and the respective division. Despite photos reaching the II Corps often on the same day, "this system was so slow, in most cases, that Divisions received prints covering an area after they had passed it."[46] Distribution seemed to be the crux of the problem, with delays caused by a lack of sufficient air couriers and ground transportation to ground unit headquarters. On D+22 (1 August), the Seventh Army photo detachment, including the 12th Photo Squadron, on Sicily received a radio and rejoined the artillery net for immediate reporting of targets of interest. The Seventh Army and II Corps usually received a text report the next morning,

with forty-six such reports issued after D-day.[47] (see figures 23 and 24) It is unknown

why such a delay occurred in getting the photo detachment connected via radio between

D+10 and D+22, though this certainly could have eased the dissemination problem much

earlier, especially for higher priority targets and activity.

Though it is unknown when American photo reconnaissance units flew the first

"dicing" mission, Major Leon Gray conducted one of the earliest over the northeastern

Sicilian coast on 27 July 1943. The tactic came from British reconnaissance units that

conducted extremely low altitude missions, and the term "dicing" came from pilots who

threw dice to see who would fly them given the significant danger involved. Despite

intense ground fire, he made runs for twenty minutes between fifty and 300 feet to obtain

photos of the "beaches, defiles, strong points, barbed wire and photos of [a] 4-gun anti-

aircraft battery."[48] Ordinarily, ground forces used "dicing" missions of beaches for

invasion planning; however, since this occurred after D-day and given its location, it

likely represented a continued effort to track German efforts to retreat from the island.

Though tested for nearly two decades, night aerial photography had its operational

debut in Sicily. Aircraft dropped flash bombs from 10,000 to 12,000 feet that triggered

the camera shutter. A single exposure covered an area roughly two miles long by four

and a half miles wide. F-10s (modified B-25s) carried a small number of flash bombs,

which normally limited missions to twenty pictures. (see figure 25) Night photos

required precise timing with fuse timers not adjustable in flight, which meant aircraft had

to fly at the same altitude, a very risky proposition. Therefore, target priority played a

major factor, as did the need for targets that pilots could easily locate at night under

obscure light conditions. Though 3d Group's Major Boyle asserted night photography

achieved success, at least one author indicated that outdated film stocks and difficulties

synchronizing the flash bombs and camera shutter negated much of the results.[49]

Moreover, the Seventh Army operational history indicated German searchlights

prematurely triggered the camera shutter thus exposing the film. Unfortunately, "a

solution to overcome this shortcoming was not found by the end of the operation."[50]

Figure 23. Overprinted Map with Axis Defenses on Sicily
Source: Seventh Army Staff, The Seventh Army in Sicily (Seventh Army Staff: 1943),
Part II, Annex 9.

Figure 24. Photo Interpretation Report Example
Source: Seventh Army Staff, *The Seventh Army in Sicily* (Seventh Army Staff: 1943),
Part II, Annex 8.

Figure 25. B-25 Medium Bomber or F-10 Photo Reconnaissance Aircraft
Source: National Museum of the Air Force, "Aircraft of the Air Force," http://www.nati onalmuseum.af.mil/research/aircraft/index.asp (accessed 7 December 2008).

Tactical Reconnaissance

Tactical reconnaissance also contributed in Operation HUSKY. The JOSS Task Force made daily tactical reconnaissance requests beyond the pre-planned missions through its air support party to the XII Air Support Command. Seventh Army advised units to check their requests against the scheduled missions before submitting them. Air support parties associated with ground units transmitted requests via radio to XII ASC liaison elements at TF 343 for overall prioritization. The process usually took two hours, and urgent taskings often flew within three hours of the request. Confusion developed when units mistakenly used this radio channel to request photo reconnaissance missions from the 111th that should have gone to the 12th Photo Squadron.[51]

Conducting operations from Tunisia presented their own challenges. Though the 111th initially planned to support nine missions (eighteen sorties) per day with its twenty-five P-51s, it later averaged ten missions (twenty sorties) per day.[52] Due to the distance from Tunisia, they only provided thirty minutes of target coverage. In essence, ten

missions would have provided about five hours of continuous coverage. The 111th

relocated to Ponte Olive airfield, Sicily, on D+4 (14 July) as planned, and later moved to

Gela. Relocating to Sicily increased loiter time pilots could spend looking for activity

and reduced some of the initial communication problems. When distance permitted, the

relocation allowed squadron liaisons to meet regularly with Seventh Army and II Corps

staffs to stay abreast of the ground situation. II Corps returned the favor by sending an

officer to the 111th every day to provide information on ground operations. When

distances increased, they relied on air couriers and radio for the same effect.[53]

Communication problems reduced the impact of tactical reconnaissance missions,

even after D+2 when the XII Air Support Command HQ moved ashore. Pilots radioed

anything significant as "flash" reports to II Corps while airborne, and the squadron

radioed the initial pilot debrief after the plane landed. Subsequent radio reports passed

the final debrief and initial photo interpretation results through the XIIth to Seventh

Army and then down echelon. This delay degraded a very timely intelligence source.

The Seventh Army operational history noted "communications [through XII ASC to

Seventh Army] were not good and it was impossible to disseminate the information

obtained."[54] In accordance with pre-planned procedures, tactical aircraft attacked many

of the targets located, but Seventh Army largely remained unaware. Later in the

campaign, pilots communicated "flash" reports directly to the divisions via radio. Even

with timely information, the inherent inaccuracies and lack of detail in the reports led the

JOSS TF to maintain a separate map from this source.[55]

<u>Effect</u>

Senior officers within the 3d Group referred to Operation HUSKY as "the first American operation to be planned and executed on the basis of information largely secured by aerial photographic reconnaissance."[56] NAPRW units flew 130 pre-D-day missions to cover Sicily's 10,000 square miles, and from 28 March 1943 through D-day, it produced 195,000 photos and 1,400 mosaics for Sicily alone. The 12th Photo Squadron flew an additional 135 successful missions after D-day with 86,000 prints, while NAPRW produced an additional 155,000 prints from those sorties. As a measure of the effect, Lieutenant General Patton commended the 12th Photo Squadron in a letter to the unit. He described how his headquarters sent an urgent request to the unit at 2300, 20 July 1943, to cover all of the south and southwest roads within twenty-five miles of Palermo. His headquarters needed the photos by 1300 the next day to decide how to employ the 2d Armored Division. With the mission successfully completed and all prints made, Patton's headquarters received the materials at 1245. He praised the unit for its support to the fall of Palermo on 22 July.[57] The Seventh Army concluded photo intelligence was invaluable, "not only were [the] most useful beaches selected, but the type of sand and exits . . . could be accurately determined."[58]

However, aerial reconnaissance still had its difficulties. Air Marshall Sir Arthur Coningham, the Northwest African Tactical Air Force Commander, endorsed Patton's letter and praised NAPRW for its work, but also commented that "before the recent operations commenced there was a period when we were having difficulty with photographic work."[59] This hinted at some of the earlier problems units had in obtaining timely aerial photos. The JOSS Task Force had stronger criticism and found aerial

photos of "little value" due to the speed of advance. One can partly explain this by the limited period covered by this report, but real problems did exist. The JOSS TF further commented on the poor timeliness with the following, "This meant that the Division was planning and fighting on information that was too old."[60] In extreme cases, photos from different days arrived simultaneously forcing units to discard the earlier mission.[61]

A quick scan of the daily Seventh Army G-2 periodic reports after D-day reveals few inputs attributed directly to photo intelligence.[62] While the G-2 section may have fused photo intelligence with other sources, the daily reports had a section for "Photo Interpretation" results. One must conclude that based on the timeliness issues described; photo reconnaissance had some difficulty keeping pace with mobile ground operations. This theme became more pronounced in the coming Italian campaign.

During a training lecture after the campaign, Lieutenant Colonel Curtiss, 1st Division G-2, described the impact of aerial reconnaissance during this operation.[63] His division received reports from the corps and army, and plotted the intelligence on maps for easier reference. Photo intelligence helped determine "general trends of enemy movements" and in most cases "enemy intentions."[64] That said, he faced difficulty ensuring that the "proper interpretation gives you the results from the photos that are taken."[65] This highlighted the challenge interpreters faced to identify correctly the activity captured on film. Though he expressed a general frustration with the limited availability of photos, in some cases, they received timely first phase interpretation reports and photos via liaison aircraft. With the benefit of an interpreter at the division, they found these photos very useful for terrain analysis, artillery targeting, and planning

ground reconnaissance patrols. Later, the divisions received a photo interpretation team of one officer and five enlisted men that further enhanced this organic capability.[66]

The 111th flew 270 tactical reconnaissance missions; ninety-six combined visual and photo capabilities, while 174 were observation only. By comparison with the 12th Photo Squadron, the 111th's missions totaled only 1,684 prints, an average of eighteen per photo sortie.[67] Notably, the Seventh Army had directed "the results of the observation were to be acted upon [by the XII ASC] without reference to Seventh Army" if communication problems developed.[68] In fact, this very situation occurred and the mission type orders proved successful. The Seventh Army later remarked, "This worked exceedingly well, and lack of information was compensated for by the knowledge that bomb targets found would be taken under fire as standard procedure."[69]

Overall, the JOSS Task Force considered the time reasonable between request and report received for tactical reconnaissance. On D-day, aerial reconnaissance, presumably tactical, located the *15th Panzer Grenadier Division* moving southwest from western Sicily. This allowed Major General Truscott to move the 15th Regimental Combat Team to block the maneuver to preserve the beachhead.[70] Colonel Koch found visual reconnaissance and the use of spot photos to confirm the observations "extremely useful," and further expressed "the enemy was seldom out of our sight."[71]

<center>Lessons Learned and Improvements</center>

While reconnaissance units corrected many lessons from North Africa and developed new tactics and techniques, others persisted. Formalized lessons learned did not occur as readily as they did following Operation TORCH and North Africa. That said, various sources do indicate the problems encountered and potential solutions.

<center>112</center>

Clearly, the most important included coordination and improving the product timeliness, while the solutions involved organizational, procedural, and resource improvements

Several important lessons resulted from the operational planning. The Army valued having reconnaissance units directly attached at the army level, despite some of the continued problems. The Seventh Army G-2 praised the first-ever allocation of a photo detachment to an army; it "proved most successful, particularly in the planning phase."[72] The G-2 further recommended pushing photo interpretation sections down to the division level. According to a British observer, the planning staff needed the following: air planners and interpreters as integral parts from the very start.[73]

The Seventh Army also identified several tactics concerning photo reconnaissance. First, it emphasized the need for comparative coverage during planning to identify activity, camouflage, and construction; even if it meant flying missions that observed no activity. A British observer echoed this thought by emphasizing the need for large-scale, detailed coverage from thirty-six-inch cameras of all beach areas.[74] Second, Seventh Army recommended division and corps engineers receive daily photos covering the route of advance to account for "minefields, obstacles and bypass sites."[75]

The G-2 also found the separation between the aircraft, photo laboratory, and interpretation section caused coordination problems and delayed dissemination. Though partly corrected by D-day, the reconnaissance units still lacked reliable communication with the divisions. As an example, though the three elements had consolidated at Ponte Olive airfield in Sicily, the lack of air couriers prevented the timely dissemination of the intelligence to the ground units. Radio communication and air couriers needed enhancement to support effective operations and get intelligence to ground forces.[76]

Tactical reconnaissance pilots had inherent limitations when observing ground activity while simultaneously trying to navigate and avoid enemy threats. While Army liaisons officers effectively briefed and debriefed 111th pilots, the lack of a basic understanding by other Army officers of these limitations relative to photo reconnaissance "led to a waste of the tactical reconnaissance squadron as far as tactical observation was concerned."[77] Coupled with communication difficulties, it is arguable that tactical reconnaissance contributed more to locating targets for air strikes than giving ground commanders any sense of what lay ahead.[78]

Though this thesis focused on aerial reconnaissance in support of ground forces, the Western Naval Task Force also discovered problems related to army operations. Since photo reconnaissance sorties would occur after forces had embarked and left port, "provision must be made in advance for interpreting the photographs and transmitting the information obtained to the flagships."[79] The task force also highlighted that repeated reconnaissance missions over the same area reduced the chance of surprise, but the intelligence gained more than compensated for the lack of surprise. Reconnaissance could also deceive an adversary by diverting attention from the true invasion beach.[80]

Finally, the Sicilian experience continued to demonstrate the resource problems present. The standard A-2 photo lab trailers within the photo squadron could not handle the volume of production needed and quickly became a single point of failure. Major Robert Boyle succinctly stated the effect, "This would have defeated the main objective in Sicily, which was to facilitate the delivery of prints to the American 7th Army."[81] The solution became two-fold, first breaking out production responsibilities between the squadrons for limited production and mass production at the headquarters level. Second,

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the photo squadron increased capacity using British darkroom tents. This pointed to the

never-ending ingenuity units used to solve even mundane problems. Production

challenges also stemmed from the limited number of multi-printers needed for mass

production capacity. One such printer could furnish one million prints per month. Based

on rumors that the 9th Air Force had abandoned such a printer at the Douglas Aircraft

Company's location in Gura, Eritrea, 3d Group personnel took a three week odyssey

through most of August 1943 to retrieve the item.[82] Similarly, the Seventh Army G-2

criticized the lack of "sufficient American photo interpretation personnel."[83]

Conclusion

With such a short period between the conclusion of operations in Sicily and the

invasion of the Italian peninsula, units had little time to reflect on the contribution of

aerial reconnaissance. The overall resource situation had improved dramatically, and the

consolidation of collection, interpretation, and production elements within the photo

center became a major source of success in Italy. The addition of artillery and engineer

experience within the photo center provided an added bonus to maximize the use of photo

intelligence. However, while photo reconnaissance played a major role in most cases

during pre-invasion planning, its ability to support mobile operations at the division and

below became more problematic. This point was particularly true in Italy where the

campaign advanced and halted between each successive German defensive position. The

integration of tactical reconnaissance somewhat balanced this shortcoming of photo

reconnaissance and became an important tactic throughout the Italian campaign.

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[1]Andrew Birtle, *Sicily 1943* (Washington, DC: U.S. Army Center of Military
History, 1993), http://www.history.army.mil/brochures/72-16/72-16.htm (accessed 26

March 2009), 3; Western Naval Task Force, JOSS Attack Force, *Annex "ITEM" to JOSS Attack Force Operation Plan No. 109-43* (1943), 1-2; Crate and Craven, vol. 2, 446-449.

[2]Seventh Army Staff, *The Seventh Army in Sicily* (Seventh Army Staff: 1943), Part I, A-8; Headquarters, Force 343, *Annex No. II to FO No. 1: Intelligence Annex* (1943), 2; Boyle, 162, 166, 522.

[3]Headquarters, Force 343, *Intelligence Plan: Operation "Bigot--HUSKY,"* (1943), 7-10; Headquarters, Force 343, *Intelligence Plan No. 2 (For Southeast Sicily)* (1943), 2.

[4]Boyle, 166, 175.

[5]Ibid., 418.

[6]Headquarters, XII Air Support Command, 12; Headquarters, Force 343, G-2, Colonel Oscar Koch, *G-2 General Information Bulletin #22* (1943), 2, 5.

[7]Boyle, 137-138, 339-340; Army Air Force Historical Office, *Participation of the Ninth and Twelfth Air Forces in the Sicilian Campaign* (Army Air Force Historical Office: 1945), 57.

[8]Of the ten F-5s, nine had one six-inch camera and two twenty-four inch cameras, and one aircraft had two thirty-inch cameras. .

[9]Seventh Army Staff, Part I, A-8 and Part II, C-2, C-3. Headquarters, Force 343, *G-2 General Information Bulletin #14: Photo Reconnaissance Plan on and After D-Day* (1943), 1; General Charles H. Bonesteel III, interview by Lieutenant Colonel Robert St. Louis, 1973, U.S. Army Heritage Collection Online: http://www.ahco.army.mil/site/ search.jsp (accessed 12 September 2008).

[10]Seventh Army Staff, Part I, A-8 and Part II, C-2, C-3; Headquarters, Force 343, *G-2 General Information Bulletin #14*, 2; Headquarters, Force 343, *G-2 General Information Bulletin #22*, 2.

[11]Headquarters, Task Force 343, *G-2 Estimate of the Enemy Situation #2* (1943), 3-11; Headquarters, Task Force 343, *G-2 Estimate of the Enemy Situation #1* (1943), 3-11; Western Naval Task Force, *Annex "ITEM,"* 3-5.

[12]Koch, 58.

[13]Ibid., 44.

[14]Alstair Pearson, "Allied Military Model Making During World War II," *Cartography and Geographic Information Science* (2002): 236.

[15]Ibid., 229-231.

[16]Boyle, 176-177; 82d Airborne Division, *82D Airborne Division in Sicily and Italy* (1945), 27-28.

[17]Boyle, 565.

[18]Albert N. Garland and Howard McGaw Smyth, *United States Army in World War II Mediterranean Theater of Operations: Sicily and the Surrender of Italy* (Washington, DC: Center of Military History, U.S. Army, 1993), 101.

[19]The term JOSS is not known to stand for anything. The sources researched used all capital letters, therefore, the author stayed with that use for historical accuracy.

[20]Headquarters, Third Infantry Division, *Report of Operations: 10-18 July 1943* (1943), 20.

[21]Combined Operations Headquarters, *C.O.H.Q. Bulletin No. Y/1: Notes on the Planning and Assault Phases of the Sicilian Campaign* (1943), 1; Headquarters, Third Infantry Division, forward, 4, 21-22.

[22]Headquarters, Third Infantry Division, 20.

[23]Naval Forces, Northwest African Waters and the Eighth Fleet, *Action Report Western Naval Task Force: The Sicilian Campaign, Operation "HUSKY" July-August 1943* (Western Naval Task Force: 1943), 81.

[24]Headquarters, Third Infantry Division, 20.

[25]British Army Captain Butler later replaced the Army Air Force interpreter. Headquarters, Third Infantry Division, 5; Combined Operations Headquarters, 11-12.

[26]Headquarters, Third Infantry Division, 5.

[27]Ibid., 21.

[28]Combined Operations Headquarters, 3, 21; Headquarters, Third Infantry Division, 20.

[29]Headquarters, Third Infantry Division, 20, 22.

[30]Combined Operations Headquarters, 1, 3.

[31]Ibid., 3.

[32]Ibid.

[33]Headquarters, Force 343, *G-2 General Information Bulletin #14*, 1.

[34]The 111th Observation Squadron officially became the 111th Tactical Reconnaissance Squadron in June 1943 because of the recommendations from the North African campaign.

[35]Boyle, 175, 522; Headquarters, Force 343, *G-2 General Information Bulletin #22*, 1.

[36]Seventh Army Staff, Part II, C-3; Part I, A-8; Headquarters, Force 343, *Intelligence Plan: Operation "Bigot--HUSKY,"* 1-2; Headquarters, Force 343, *G-2 General Information Bulletin #14*, 1.

[37]Boyle, 624.

[38]Seventh Army Staff, Part II, C-3.

[39]Headquarters, Force 343, *G-2 General Information Bulletin #22*, 2-3; Headquarters, Force 343, *Intelligence Plan: Operation "Bigot--HUSKY,"* 1-2; Boyle, 522; Headquarters, Force 343, *G-2 General Information Bulletin #14*, 1.

[40]Headquarters, Force 343, *G-2 General Information Bulletin #22*, 4.

[41]Seventh Army Staff, Part II, C-4; Headquarters, Force 343, *Intelligence Plan: Operation "Bigot--HUSKY,"* (1943), 7; Headquarters, Force 343, *Intelligence Plan No. 2*, 2; Headquarters, Force 343, G-2, Colonel Oscar Koch, *G-2 General Information Bulletin #22* (1943), 4; Headquarters, Force 343, *Annex No. II to FO No. 1: Intelligence Annex* (1943), 1-2.

[42]Seventh Army Staff, Part II, C-4.

[43]Ibid., Part II, C-3 and C-4.

[44]Western Naval Task Force, *Annex "ITEM,"* 13-14

[45]Seventh Army Staff, Part II, C-3; Boyle, 321-324, 522; Headquarters, Force 343, *G-2 General Information Bulletin #14*, 1-2.

[46]Seventh Army Staff, Part II, C-3.

[47]Ibid.

[48]Boyle, 611,612, 614; 3rd Photo Group, 39.

[49]Boyle, 6-7, 612-613; George W. Goddard, *Overview: A Lifelong Adventure in Aerial Photography* (Garden City, NY: Doubleday & Company, Inc., 1969), 244; Stanley, *World War II*, 156.

[50]Robert Boyle contends that despite the inherent challenges, the crews achieved remarkable success with night photos including photographing ninety-eight percent of the targets tasked and of those collected, eighty-five to ninety percent of the target areas were covered within the photos. However, the Seventh Army operations history strongly countered this assertion. Boyle, 613; Seventh Army Staff, Part II, C-3.

[51]Headquarters, Third Infantry Division, 25; Headquarters, Force 343, *G-2 General Information Bulletin #22*, 1-2; Seventh Army Staff, Part II, C-4.

[52]Ten of these aircraft had cameras, both a seven-inch vertical and a seven-inch oblique. In all the sources used for this thesis, the Seventh Army history is the only one to reference a seven-inch camera. Instead, this was likely a six-inch camera. .

[53]Garland and Smyth, 107; Seventh Army Staff, Part II, C-3 and C-4.

[54]Seventh Army Staff, Part II, C-4.

[55]Headquarters, Third Infantry Division, 25-26; Headquarters, Force 343, *G-2 General Information Bulletin #22*, 1-2; Seventh Army Staff, Part II, C-4.

[56]Boyle, 505.

[57]Seventh Army Staff, Part II, C-3; Koch, 58; Boyle, 422.

[58]Seventh Army Staff, Part II, C-7.

[59]Boyle, 424.

[60]Headquarters, Third Infantry Division, 22.

[61]Ibid., 22, 26.

[62]Seventh Army Staff, G-2 Annex #6.

[63]Lieutenant Colonel Curtiss' first name is unknown.

[64]Allied Force Headquarters, Intelligence Training Center, *Notes on Lecture Given By Lt. Col. Curtiss on Functions of Division G-2* (1943), 3.

[65]Ibid.

[66]Ibid., 3-4.

[67]Seventh Army Staff, Part II, C-4.

[68]Ibid.

[69]Ibid.

[70]Headquarters, Third Infantry Division, 57; Garland and Smyth, 155.

[71]Koch, 58.

[72]Seventh Army Staff, Part II, C-7.

[73]Ibid., Part II, C-8; Combined Operations Headquarters, 18.

[74]Combined Operations Headquarters, 18.

[75]Seventh Army Staff, Part I, C-2, C-7.

[76]Ibid., Part II, C-7 and C-8.

[77]Ibid., Part II, C-7.

[78]Ibid., Part II, C-7 and C-8.

[79]Naval Forces, 81.

[80]Ibid., 81.

[81]Boyle, 316.

[82]Ibid., 6, 221, 316, 593-594.

[83]Seventh Army Staff, Part II, C-7.

CHAPTER 5

ITALY: AERIAL RECONNAISSANCE MATURES

Just twenty-three days elapsed between the end of operations in Sicily and the

invasion of Italy; a major feat given the involvement of many of the same units in both

operations. The invasion of Italy included several amphibious landings. Operation

Baytown involved the British Eighth Army landing on Italy's toe on 3 September 1943

and the V Corps landing on Italy's heel on 10 September in Operation Gibbon.

Operation Avalanche involved the Western Task Force supporting the Fifth Army's

landing at Salerno, Italy, on 9 September. Unlike the nearly unopposed landings in North

Africa, German armor, infantry, artillery, and air forces of Army Group B opposed the

allies, with the Tenth Army in the south to defend Salerno and the Fourteenth Army in

northern Italy. In somes cases the initial waves made it ashore, but then German units

pinned them down under intense fire from the high ground. Veteran German divisions

from the eastern front then began a series of counter attacks against the beachhead that

reached within three miles of the beach and threatened the entire operation.[1]

After the breakout from Salerno, the campaign became much more mobile in

nature until German forces reformed on the Gustav defensive line. As American units

struggled to break through those positions, allied leaders planned an amphibious assault,

Operation SHINGLE, behind German lines at Anzio in January 1944. German use of the

Italian terrain caused the campaign to surge and stall correspondingly as they retreated to

the next set of prepared defenses. The Fifth Army's planning staff used photo

intelligence to determine how best to meet each new set of obstacles. With each major

penetration of German defensive positions, there followed a brief mobile phase followed

by yet another static period. German units generally withdrew to the first suitable feature

behind the current position that served as a holding for a limited period. The holding line

enabled a withdrawal to a much stronger line with concrete emplacements, pillboxes,

mine fields, and anti-tank defenses along advantageous terrain features such as rivers and

ridges.[2] Figures 26 and 27 highlight the major defensive lines and respective periods:[3]
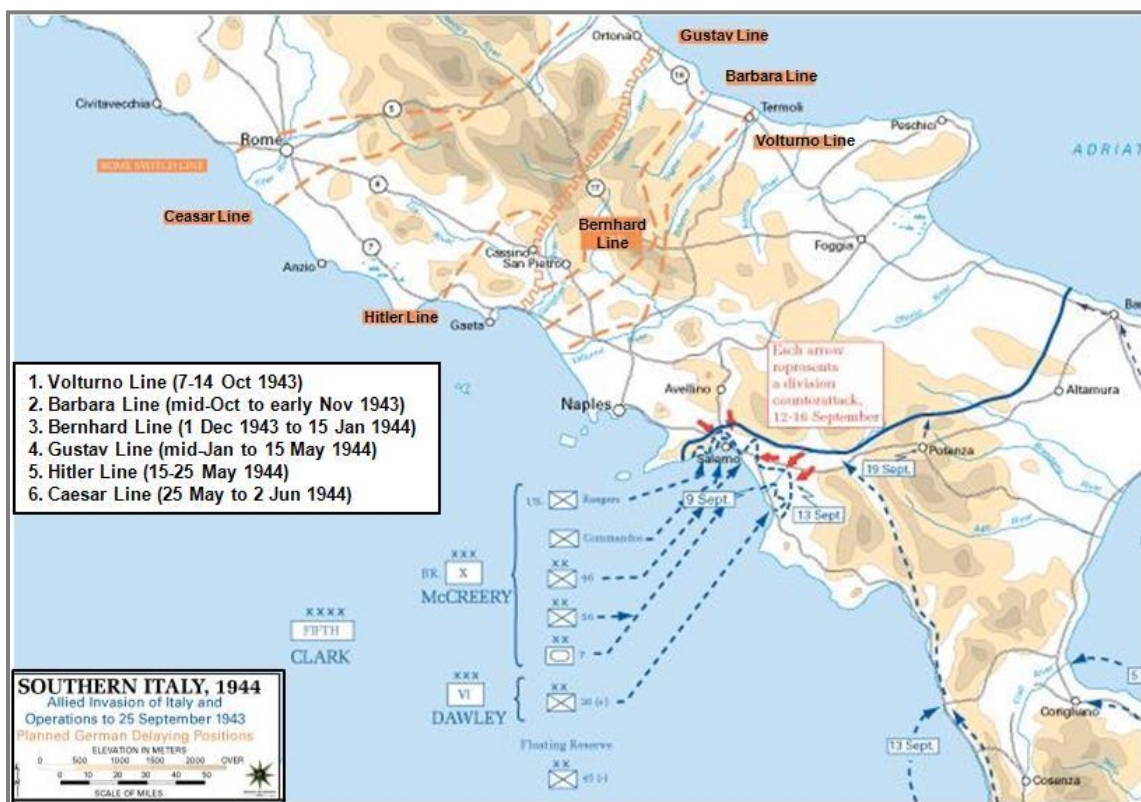
Figure 26. Southern Italy Operations, September 1943 to June 1944
Source: World War II, European Theater, "Allied Invasion Of Italy And Operations,
September 1943," U.S. Military Academy, http://www.dean.usma.edu/history
/web03/atlases/ww2%20europe/EuropeanTheaterGIF/WWIIEurope47.gif (accessed 16
April 2009).
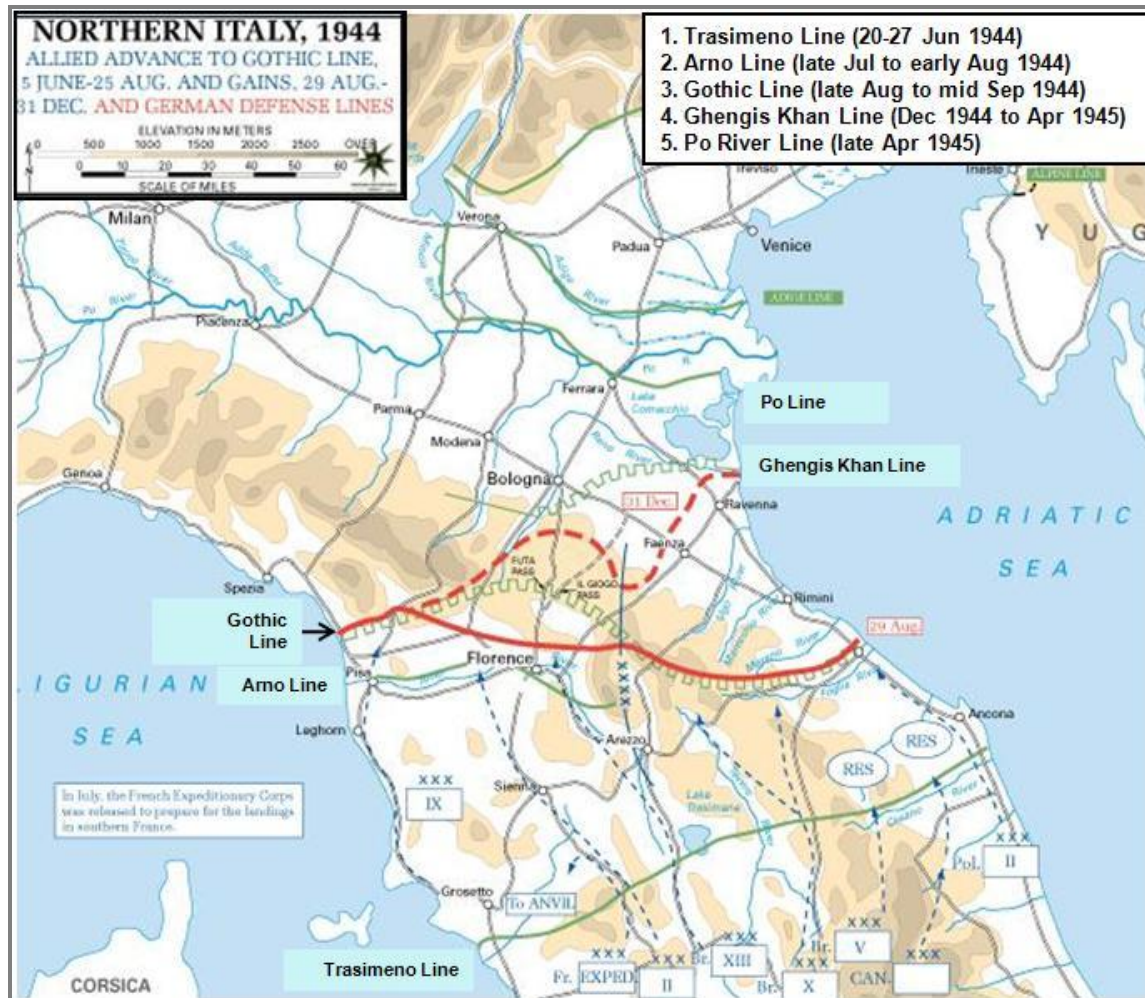
Figure 27. Northern Italy Operations, June 1944 to May 1945
Source: World War II, European Theater, "Allied Offensives In Italy, 5 June- 31 December 1944," U.S. Military Academy, http://www.dean.usma.edu/history/web03 /atlases/ww2%20europe/EuropeanTheaterGIF/WWIIEurope51.gif (accessed 16 April 2009).

<u>Organization</u>

The 3d Group supported Fifth Army throughout the Italian campaign with the

12th Photo Squadron and intermittently with the 5th Photo Squadron. Using the 12th

ensured continuity between the recent operations in Sicily and the lessons and experience

the unit gained. Similar to the Seventh Army photo interpretation detachment, the Fifth

Army stood up a photo center, a joint Army and Army Air Force organization at the operating airfield.[4] Figure 28 shows the command control relationship and the flow of information between the reconnaissance units, Fifth Army, and other Army Air Force units in theater.
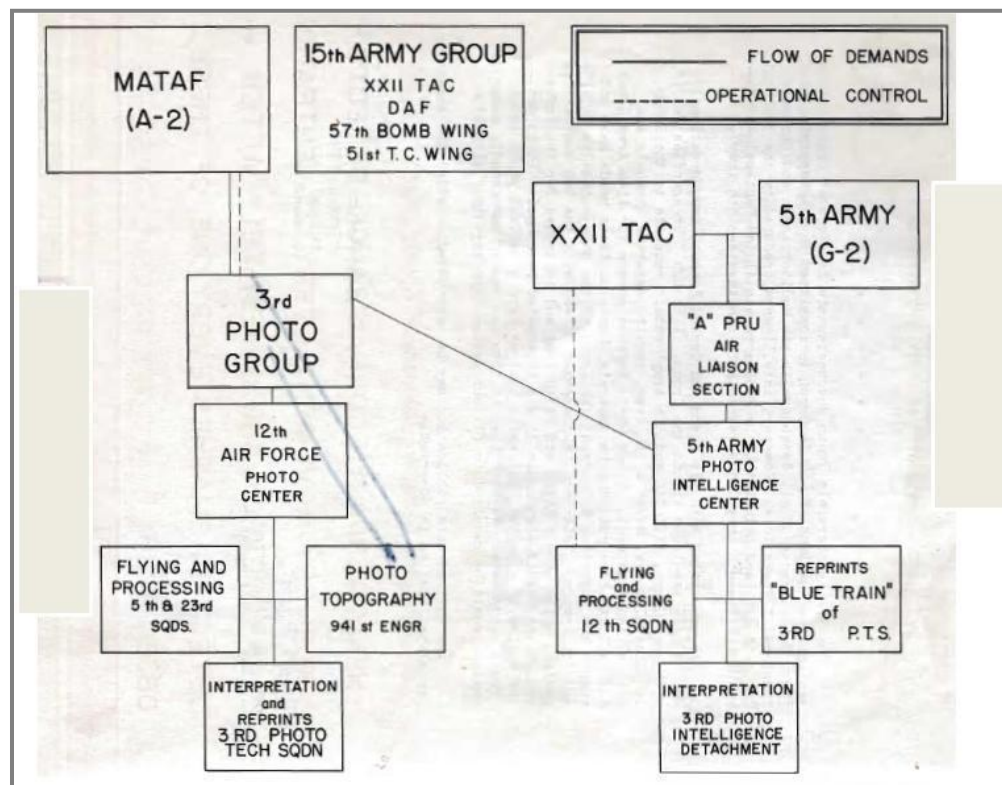
Figure 28. 3d Photo Reconnaissance Group Relationship to Fifth Army Photo Center
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), ii.[5]

Meanwhile, the Fifth Army G-2 section received a British Photo Reconnaissance Unit (PRU) to serve as liaisons with the photo center. The PRU had thirteen personnel, with the commander located at the Army HQ and the other two officers and personnel at the photo center. The PRU managed all of Fifth Army's photo reconnaissance

requirements and communicated those and the ground operational plan to its counterparts at the photo center for execution.[6] Interestingly, the 3d Group took great pride in its direct coordination relationships with supported units like the Fifth Army:

> [This relationship is] not to be found in any field manual and deliberately by-passes any normal channels.[7] The system used by the 5th Army has proven very successful. It is not to be found in any book; it was never taught in any school--it is the product of trial, error, and bitter experience. Today we feel that the most efficient tactical set-up has finally been achieved.[8] [emphasis in original]

In March 1944, NAAF became the Mediterranean Allied Air Force, and NAPRW likewise became the Mediterranean Allied Photographic Reconnaissance Wing (MAPRW).[9] Shortly afterward, the 3d Group moved under the Mediterranean Allied Tactical Air Force. With the 5th Photo Reconnaissance Group under the 15th Air Force and the 12th Photo Squadron working for Fifth Army, MAPRW disbanded on 1 October 1944.[10] This action discarded one of the central cornerstones of the North Africa experience in favor of improving timeliness and tightening the targeting process.

To support the invasion of southern France, the 111th Tactical Reconnaissance Squadron transferred to the XII Tactical Air Command (TAC) when the later transitioned to support the Seventh Army invasion in July 1944. A conference held in September 1944 confirmed the 111th would not return to the Italian theater. The newly created XXII TAC that remained in Italy to support Fifth Army received support from the British No. 225 and 208 Tactical Reconnaissance Squadrons.[11] Fifth Army also received support from a French squadron after April 1944.[12] It is unknown whether any additional Army Air Force squadrons supported Fifth Army after summer 1944.

Support to Amphibious Invasions

Operation AVALANCHE

Once again, invasion planning started well before troops went ashore. During

July and August alone, the 5th Photo Squadron mapped roughly five sixths of the Italian

peninsula and a strip of coast fifty miles deep from Italy to Spain in addition to its normal

requirements. Experience from North Africa and Sicily stressed the significance of beach

intelligence. Photo intelligence provided critical information on beach composition and

exits, shallow water obstacles, sand bars, and estimated water depth. From this analysis,

planners assessed northern beaches provided better access than those in the southern

sector since the latter required pontoons for the Landing Ship Tanks to pass a sand bar.

Aerial photos furnished excellent coverage of the surrounding terrain including the flat

plain behind the beaches that transitioned to rugged hills, the lack of fordable sites across

the Sele River, and the mountains on the Sorrento Peninsula.[13]

> The arc of mountains enclosing the plain of Salerno was too far from the beaches
> for the assaulting troops to reach before daylight. Even after a successful landing
> the Allied forces would have to defend an open plain under possible constant
> enemy observation and artillery fire. Yet certain favorable characteristics made
> the selection advisable. The offshore gradient permitted transports to come close
> to shore; the strip of sand between the water and the dune line was fairly narrow
> and made the construction of exit routes relatively easy; the low dunes themselves
> offered no serious obstacles to bulldozers; and the existing road net lay close to
> the beaches. Finally, the terrain immediately behind the beaches was suitable for
> the dispersion of dumps.[14]

After-action reports validated much the same about the intelligence picture, "The

actual conditions encountered on the assault beaches confirmed in all material aspects the

accuracy of these estimates."[15] For the immediate beach area, aerial photos located four

fixed artillery batteries totaling sixteen 75-mm. to 149-mm. guns, a number of long-range

railway batteries, mobile 88-mm. batteries, three minefields, twenty-five machine gun

positions of varying types, and many other defenses. Task Force planners later

concluded "the estimate of fixed enemy defense disseminated to all forces prior to the

assault, was found to be generally accurate."[16] Intelligence assessed that defenses in the

immediate landing area lacked organization. The bigger threat remained German

armored forces outside of the beachhead and the ability of observation posts in nearby

mountains to direct artillery fire. Of note, the mobile artillery caused such difficulty it

later forced the temporary closure of two of the original four beaches.[17]

Analysts disseminated information on overprinted maps in 1:50,000 and 1:25,000

scales with all known artillery positions. Due to the limited preparation time, map

shortages forced greater reliance of photos and mosaics with annotations to identify

defensive positions. (see figure 29) Ground forces received oblique photos for Salerno

with annotations of code names and special instructions, and vertical photos with beach

defenses. NAPRW took great pride that platoon leaders had such photos and thought this

justified the risk of such low-level missions. The photo center continued to use terrain

models as a unique method to represent the terrain and enemy situation. However,

operation planners offered the following cautionary note:

> The principal source of information concerning CD [coastal defense] batteries and
> beach defenses is the interpretation of aerial photographs. The skillful use of
> camouflage by the enemy and the lack of sufficient photographic cover render it
> possible that defenses exist where none have been reported. Batteries may be
> placed in cliffs or inside buildings and consequently would never appear in
> photographs.[18]

As evidenced, analysts knew nearby Punta Licosa had 204-mm. guns, yet they were

never located on aerial photos.[19]

The Fifth Army photo center played a pivotal role after the invasion commenced

by providing a centralized location to coordinate and interpret aerial photos. Each

mission produced at least two sets of prints, one for the photo center and one for the respective corps for immediate interpretation. The corps further split its prints between its respective divisions for exploitation by their interpreters. Subsequent sets allowed the divisions to push additional photos down to lower echelons. The photo center had six interpreters and produced results for the entire Fifth Army, especially the counter battery staff, while the corps and divisions each had two.[20]
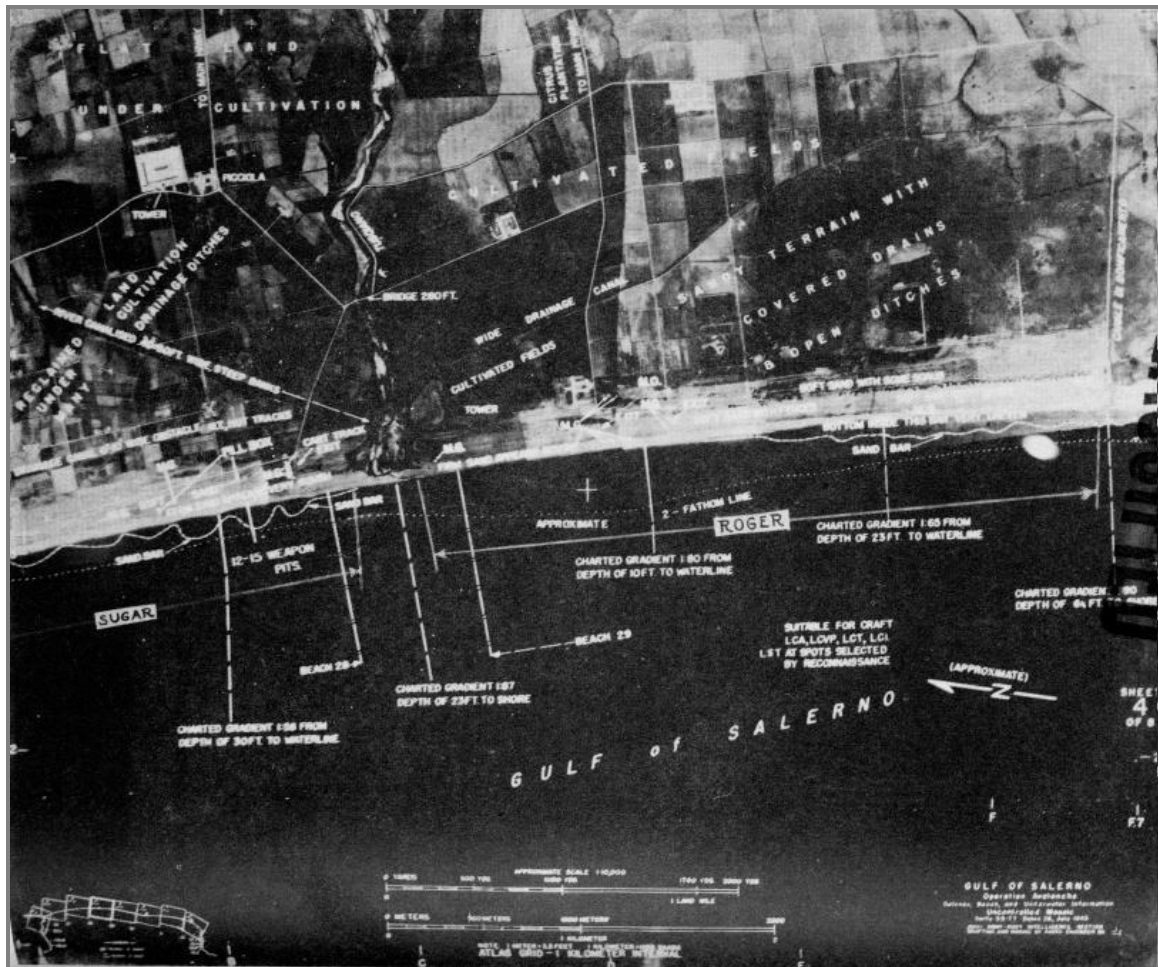
Figure 29. Operation AVALANCHE Overview Photo of Landing Beaches
Source: Western Naval Task Force, *The Italian Campaign-Western Naval Task Force: Action Report of the Salerno Landings September - October 1943*, (1943), 190.

Learning from earlier campaigns, the photo center included not only Army photo interpreters, but also artillery and engineer officers. Three artillery officers fused intelligence via detailed maps from many sources including sound ranging, artillery tube flash, and prisoner interrogations among others. These sources provided tips on where to look on the photos. Once confirmed, survey personnel fixed the location and the counter battery officers passed the results immediately by radio to corps artillery for action. Similarly, five engineers helped discern road, railroad, and bridge conditions, and approximate the quantity of resources and time required to make repairs. These additional specialties made an important addition to the photo center's overall capability and ultimately improved the reports and products it delivered to Fifth Army units. British Major F. R. Fuglesand, chief of the Photo Reconnaissance Unit, found the engineers crucial and recommended pushing them down to the divisions as well.[21]

To provide this support, NAPRW flew 1,001 missions from 1 August through 15 September 1943 for all service requirements in Sicily and Italy. On average during this period, nine of twenty-seven aircraft were non-operational. While British, South Africans, and French did help balance the shortfall, they provided a limited contribution and had collection requirements for their individual nations to fulfill. Of these sorties, the Germans intercepted ninety-three, while another sixty-seven encountered anti-aircraft fire.[22] Overall those numbers appear relatively low, just over 15 percent. It reflected several factors: single aircraft at high altitude drew less attention; Germany had to divert fighters to other fronts; and the gradual attrition of the German Air Force.

The intense demand kept laboratory machines in near continuous operation for forty days. When the main water supply ran short at one point, technicians hurried the

prints down to the shore and used seawater. Other resource shortages forced the use of captured German generators, film, and chemicals. The scale of resources used during this period was impressive: over one million gallons of water, over 300,000 negatives, 1.2 million prints, and 31.5 tons of dry chemicals mixed to 34,000 gallons.[23] Major Phillip Kennedy, the MAPRC Assistant Chief of Staff, remarked resource shortages caused the "loss of much of the intelligence which could actually be delivered from photographs for the Army Ground Forces."[24]

Though not every mission directly supported Army requirements, many indirectly supported the Salerno invasion. In addition to ground targets covered, NAPRW covered the following air and naval requirements:

1. South of 42º in Italy: daily coverage of forty-nine airfields, fifteen marshalling yards, and six ports

2. France and North of 42º in Italy: coverage of 298 other targets whether covered on a daily, bi-weekly, weekly, bi-monthly, every three weeks, or monthly basis

3. Special targets: additional 251 for charting and specialized purposes

One-half of the missions supported mapping requests of southern France and Italy that covered almost 200,000 square miles. The resource competition strained the reconnaissance units to satisfy so many unique requirements and customers. With air superiority essentially achieved in early 1944, a shift in emphasis occurred. In March 1944, Major Phillip Kennedy summarized this support: 15 percent to the 15th Air Force, 12 percent to the 12th Air Force, 29 percent to various organizations including the Navy and the AFHQ G-2, and 44percent to Army forces.[25]

The actual invasion prompted changes in information dissemination and preparations for the first major relocation of reconnaissance units since June when NAPRW moved from Algeria to Tunisia. With the Fifth Army afloat from 29 August to 9 September 1943, the photo center maintained regular coverage of the landing beaches and enemy positions during the transit. It flew fifteen successful sorties out of twenty, but communication problems blocked attempts to pass results to command and control ships. Radio contact was re-established with the Fifth Army's command post on D+3 to pass results and receive requests. On D+7, P-38 courier flights began arriving at Paestum air strip within the beachhead to deliver prints and reports for X and VI Corps along with the regular radio broadcast of first phase reports. Prints were usually 24 hours old once they arrived at the units. The courier flights and improved radio communication also gave NAPRW reports on the ground situation. Similarly, the XII Air Support Command collocated with the Fifth Army HQ after the Salerno invasion. This permitted tactical reconnaissance missions to occur within one to two hours of the request.[26]

Early in the Italian campaign, the Photo Reconnaissance Unit (PRU) and photo center mastered the tasking process. Major Fuglesand, the PRU Chief, stated that except for thirty-six inch camera coverage that required special coordination, the PRU passed few requests given their ability to plan and "anticipate nearly all demands."[27] For urgent requirements, by August 1943 the PRU and 3d Group had developed a finely tuned process to quickly respond. The unit received late night requirements and dispatched a courier aircraft before daylight that arrived at the forward unit just after sunset. Once received, the forward unit flew the mission during optimal photographic light and

returned not to the forward unit, but back to NAPRW headquarters. NAPRW expedited film development and interpretation to release its report by 1300 the same day.[28]

Once again, photo reconnaissance played major role in an amphibious invasion. The Fifth Army history concluded "photo reconnaissance had provided accurate information on the beaches."[29] NAPRW flew 572 missions in September 1943 alone, including 34 missions in a single day, and covered 180,000 square miles (nearly twice the size of Italy) for all services. Figure 30 displays the coverage available in various product types. The 3d Group flew seventy-nine missions that month to cover the Salerno area daily. Fifth Army placed such a demand on photographic resources, that NAPRW assigned it a full squadron to meet the requests. This demonstrated a strong commitment by NAPRW to work closely with supported ground forces.[30] From 1 August to 15 September alone, NAPRW produced 951 interpretation reports and 1.2 million photo prints in support of Fifth, Seventh, and the British Eighth Armies. Lieutenant General Mark Clark, the Fifth Army Commander, praised NAPRW in early September for producing 160,000 prints for his command's planning and execution. Of note, he commended those responsible for the mosaics and low obliques that proved invaluable.[31]

Tactical reconnaissance also played an important role in the Salerno invasion with 314 missions flown by the XII Air Support Command in September 1943. XII ASC had the 111th and the British No. 225 squadrons initially scheduled for on-call and pre-planned missions. Since the squadrons provided only six missions (twelve sorties) per day, pre-planned missions became necessary because the number of requirements overwhelmed the aircraft available. As such, the units likely scheduled aircraft to cover multiple requirements from different units on the same mission. Pre-planned coverage

ended after D+3 and the 111th supported VI Crops and the British No. 225 Squadron assisted the British 10th Corps. Pilots reported any significant observations to the *USS Ancon* while returning to base, and the XII ASC rear HQ in Sicily followed this up with the full mission debrief. Communication seemed satisfactory, yet participants were marginally satisfied with the tasking process and reception of reports. As with Sicily, the 111th later relocated to the Salerno beachhead a week after the invasion.[32]

Tactical reconnaissance also contributed to artillery fire adjustment. Sometime before the invasion, a conference of British and American officers decided to train P-51 tactical reconniassance pilots on naval gunfire spotting. Three navy officers served with the XII ASC to provide training on naval gunfire spotting procedures and coordinate these requests between the Western Task Force and XII ASC. Procedural differences between the Army and Navy presented the biggest difficulty. Combining the two procedures had limited support, but the theater opted to leave them unchanged. As a result of these efforts, the 111th provided the first P-51 related artillery adjustment of the war on 18 September 1943 in support of this invasion, though admittedly nine days after the invasion.[33] Overall, the tactic proved "exceptionally successful," although the squadron only provided four P-51s toward the effort due to other taskings.[34]
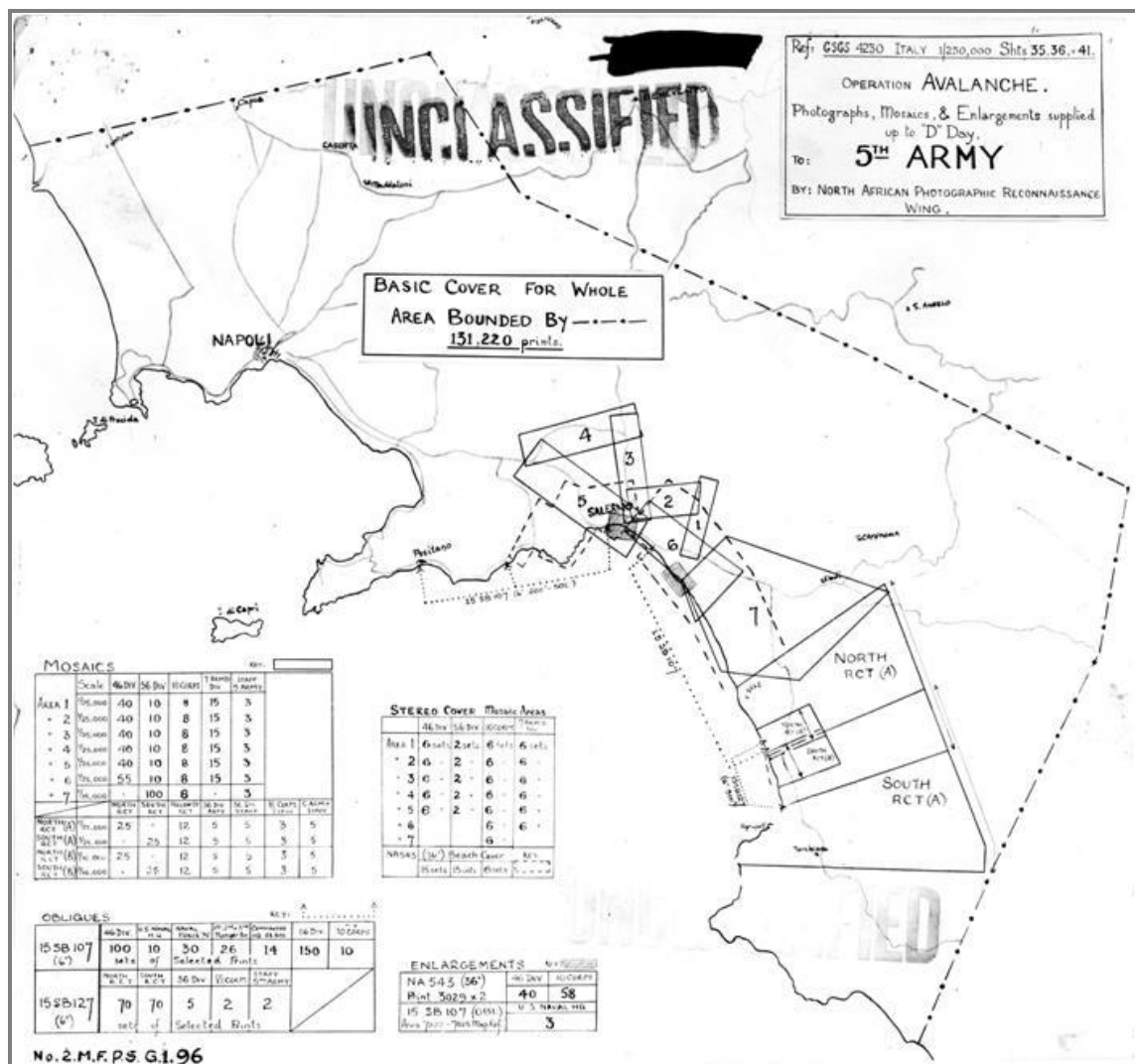
Figure 30. Operation AVALANCHE Pre-Invasion Coverage and Photo Distribution
Source: Headquarters, Mediterranean Allied Photo Reconnaissance Command, *Memo from Maj. Phillip Kennedy to Col. John Warren,* Combined Arms Research Library Number: N3474, 16 January 1944.

Operation SHINGLE

The Mediterranean Allied Photographic Reconnaissance Command (MAPRC)[35]

committed an entire group to support the amphibious invasion at Anzio. In addition to

the basic cover provided months before, MAPRC flew 14 special missions 2-19 January

1944 that provided the basis for change anaylsis of the coastal areas and the latest details

on German positions. According to a post invasion report, Anzio planning support did

not interfere with ongoing operations elsewhere along the Fifth Army front. Like the

previous two invasions, missions focused on intelligence of the beaches and enemy

defenses. The plan included coverage 2,000 yards behind the lines and night

photography of point targets fifty to seventy-five miles behind the lines to locate supply

dumps and the direction and density of German movements. The two biggest differences

from the Salerno planning included: sufficient numbers of beach obliques to provide one

to each assault platoons, and much of the cover was flown at 1:25,000 scale which

allowed it to easily join existing coverage of neighboring areas in large mosaics.

MAPRC flew the last pre-invasion sortie on D-3; after which it flew pre-planned

missions on D-day and D+1, then as needed from D+2 and beyond.[36]

The Fifth Army photo center provided all of the bulk photo print production and

interpretation, while MAPRC constructed the mosaics. Interpretation of aerial photos

showed only three suitable landing beaches in the Anzio area, while analysis of beach

gradients permitted navy planners to determine what vessels types each beach could

accommodate. The analysis was "fully substantiated in the actual landing."[37] The photo

center produced over 120,000 prints; enough copies for each division to push to its lower

echelons. The center made three 1:10,000 mosaics with annotations highlighting

defensive positions and terrain features in sufficient quantities for each platoon to have a

copy of their respective area. Since interpreters finished exploiting the D-3 sortie before

forces loaded for the invasion, units underway did not receive a broadcast of the latest

intelligence.[38] Figures 31 to 34 show the overall pre-D-day coverage provided and

representative examples of vertical and oblique photos.
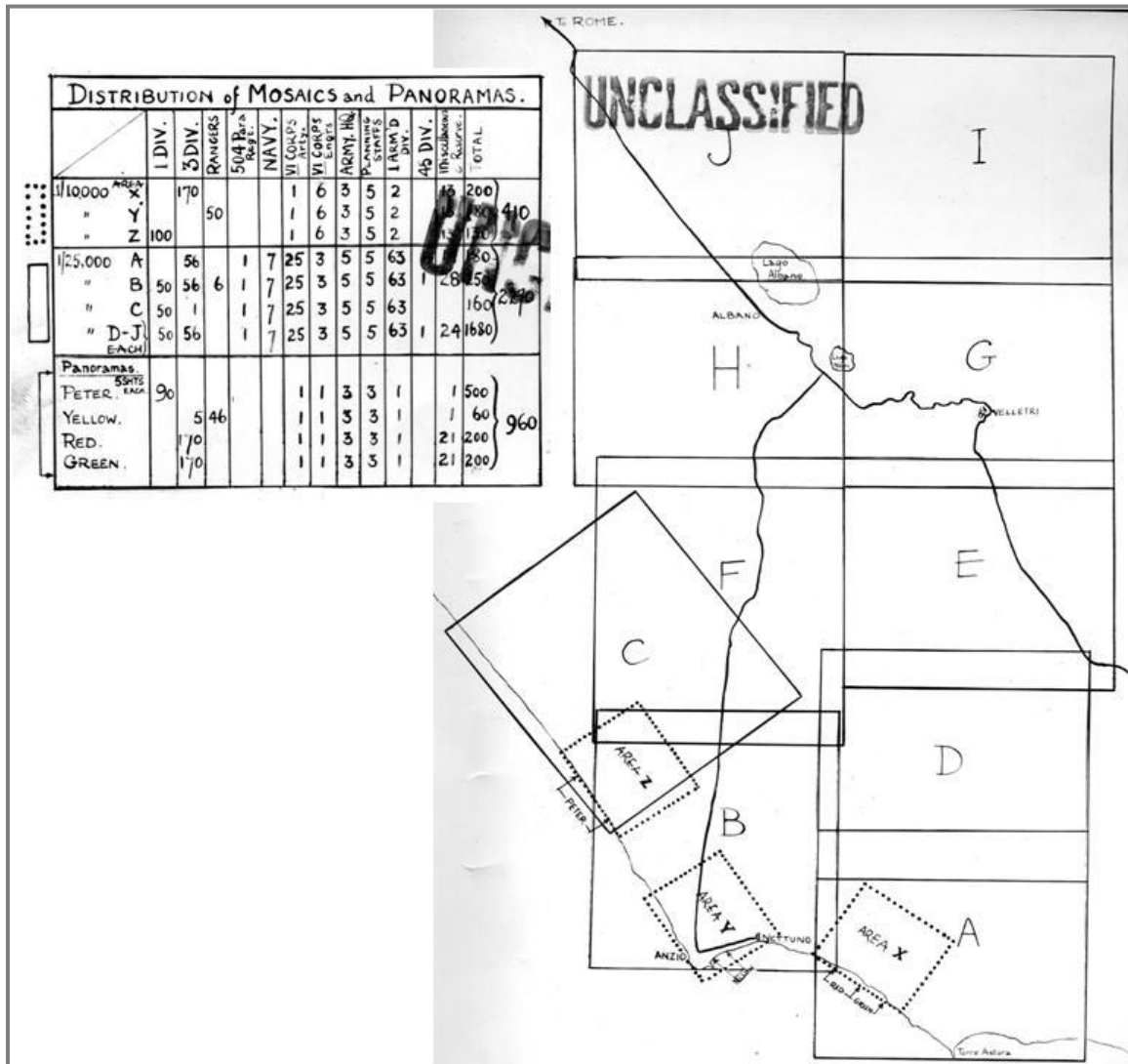
Figure 31. Operation SHINGLE Pre-Invasion Mosaic and Oblique Coverage
Source: Mediterranean Allied Photographic Command. *Photographic Program of
M.A.P.R.C. with Fifth Army Operation 'SHINGLE'* (1944), Diagram #1.
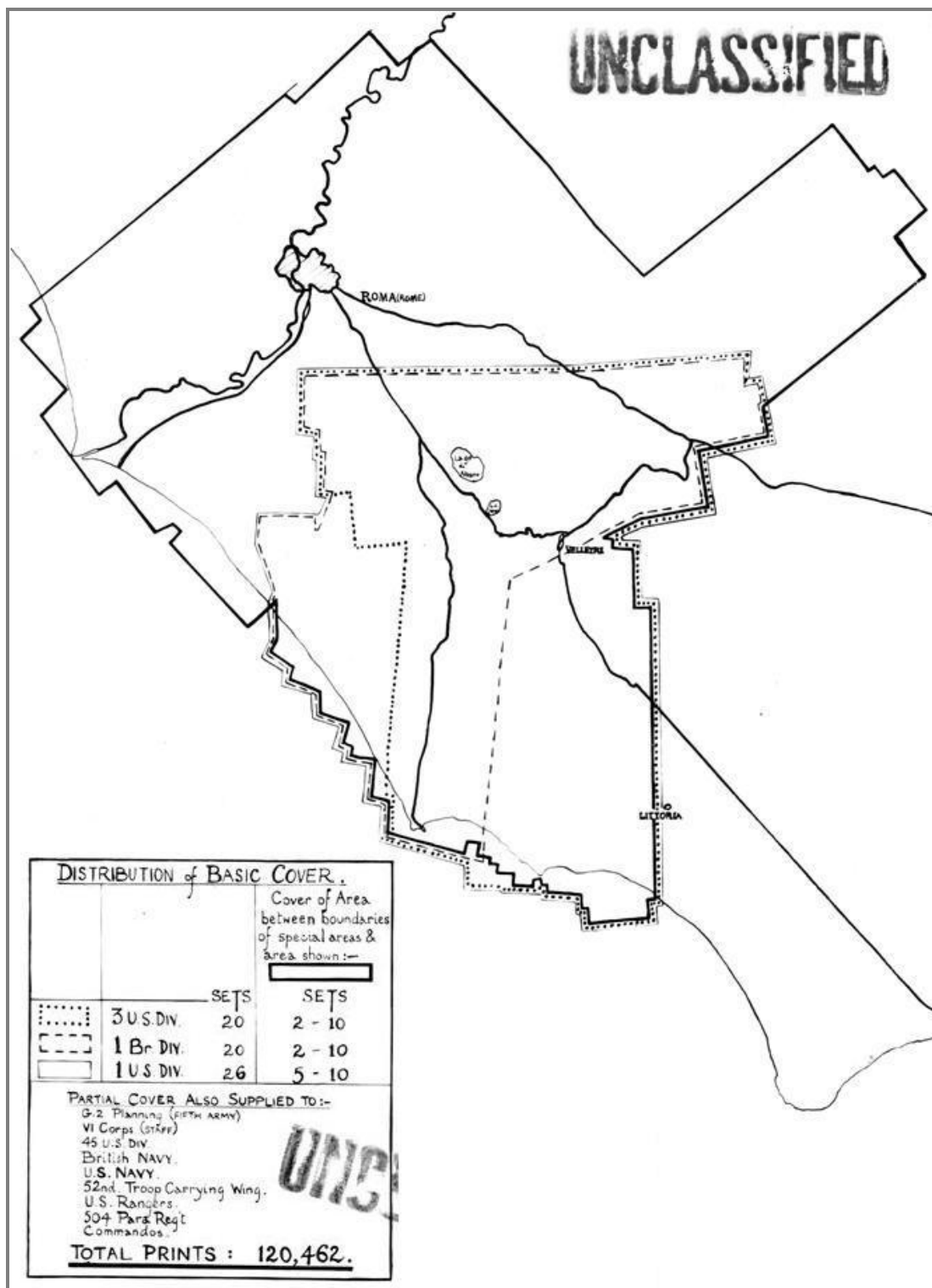
Figure 32. Operation SHINGLE Pre-Invasion Basic Cover and Photo Distribution
Source: Mediterranean Allied Photographic Command. *Photographic Program of M.A.P.R.C. with Fifth Army Operation 'SHINGLE'* (1944), Diagram #2.
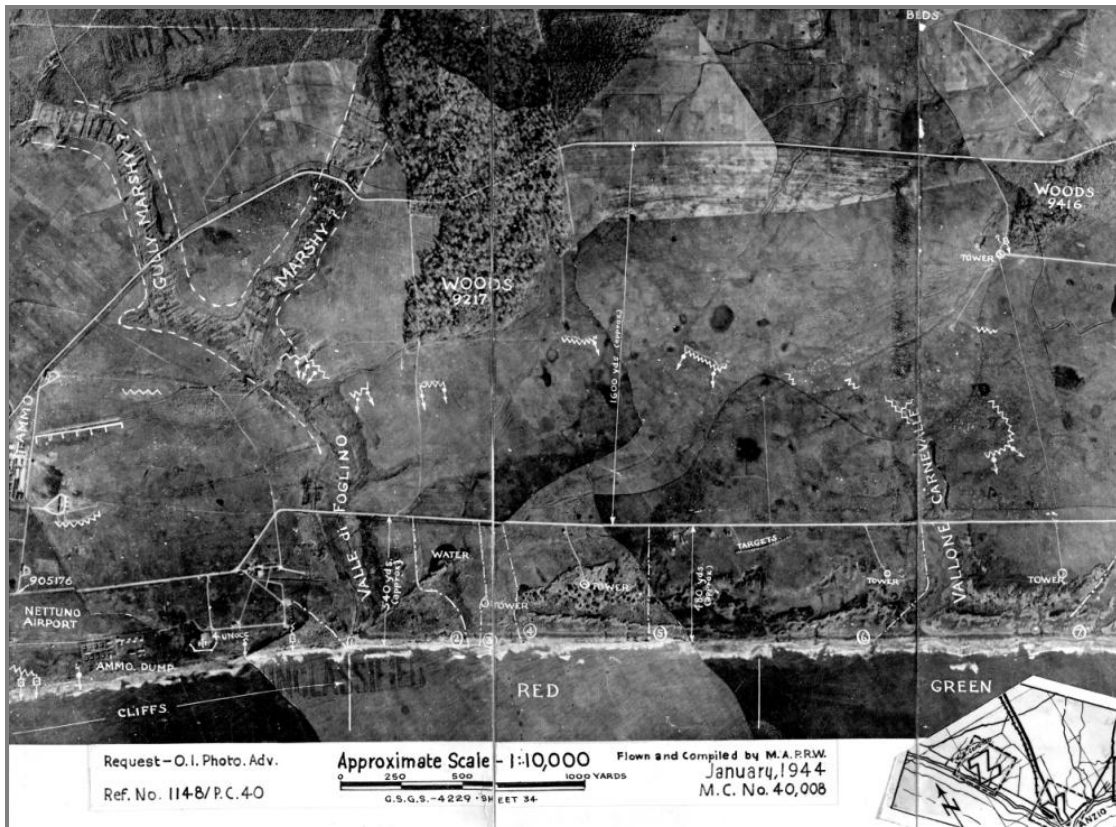
Figure 33. Operation SHINGLE Pre-Invasion Photo of Defenses and Terrain Features
Source: Mediterranean Allied Photographic Command. *Photographic Program of M.A.P.R.C. with Fifth Army Operation 'SHINGLE'* (1944).

Figure 34. Operation SHINGLE Pre-Invasion Oblique Photo of Yellow Beach
Source: Mediterranean Allied Photographic Command. Photographic Program of M.A.P.R.C. with Fifth Army Operation 'SHINGLE' (1944).

By D+6 (28 January 1944), an emergency landing strip within the Anzio beachhead became available. This permitted prints and reports to be delivered to VI Corps HQs by 1000 the day after being flown. A 12th Photo Squadron forward detachment moved there and flew fifteen dicing missions from one hundred to 3,000 feet covering the entire frontline for immediate exploitation by VI Corps. Satisfied with the results, the Fifth Army requested continued use of obliques throughout the Italian campaign for ridges, rivers, and defensive lines.[39]

For other 3d Group missions flown, the Fifth Army photo center provided the focus for exploitation and immediately broadcast results via the A9 radio net. This allowed the center's counter battery officers to pass targets for immediate attack. To pass photo requirements, the Fifth Army and its corps used the secure A1 net due to security concerns about what the requirements might reveal about future intentions. After the invasion on 22 January 1944, reconnaissance units played a vital role in locating German artillery that threatened the beachhead. After a week of bad weather, photo missions on 6 February located an increased concentration of artillery. Two days later, photos revealed even more, with 170-mm. artillery pieces and at least one railroad gun. These artillery pieces generally provided inaccurate due to their distance, but the congested beachhead made casualties and damage to material inevitable and often forced delays. Since the artillery was beyond the range of corps artillery, the 111th's F-6s directed naval gunfire against the positions with "good results." This became standard practice along the flanks of the beachheads to the range of naval gunfire. With the beachhead in a precarious position, "reconnaissance planes spotted an increase in rail movements and heavy traffic on all the secondary roads leading from the Rome area to the beachhead." This allowed

the Fifth Army Commander, Lieutenant General Mark Clark, to committ the British 56th Division to reinforce the beachhead.[40]

Tactical reconnaissance presumably played a similar role in this invasion as it did in Operation Avalanche. Unfortunately, research for this thesis revealed little of its contribution. Of note, based on lessons from Salerno and variations in spotting procedures, F-6 pilots spotted for ground forces during Operation Shingle while British pilots handled naval gunfire missions. While a temporary measure, airmen still recommended standardizing procedures for both types.[41]

The organizations involved in Operation Shingle identified very few lessons learned. The complex terrain and German camouflage efforts continued to emphasize the need for more thirty-six inch cameras to provide the detail necessary to discern enemy defensive positions. When units flew shorter focal length cameras at lower altitudes to achieve the same effect, aicraft losses proved too costly. This operation once again reinforced the need for centralization to meet the production requirements needed for a major amphibious operation. Due to insufficient mass processing capabilities within the beachead, unless MAPRC got the results back immeidately via radio or courier aircraft, the results were often useless.[42] Finally, an observer of the PRU led by Lieutenant Colonel Fogelman noted that on "such liaison hinges almost the entire success of this very practical working arrangement."[43]

Tactics, Techniques and Procedures

Tasking

As previously discussed, the experience in Tunisia caused greater centralization of collection management functions under the Mediterranean Photo Intelligence Center

(MPIC) in February 1944. This organization required all units in the Mediterranean to submit photo requirements through it for satisfaction, with the exception of those that had reconnaissance elements directly assigned. This caveat permitted the relationship between the 5th and 12th Photo Squadrons to operate with Fifth Army, despite efforts to centralize control. Though this arrangement appeared to bypass MPIC, it regularly levied requirements on the squadrons. As added benefits, the direct relationships created long-standing ties that increased familiarity between the units and with the terrain to improve accuracy and to reduce combat losses.[44] This relationship demonstrated the balancing act between centralized control and the need to be responsive to ground units.

Immediately upon activation, MPIC started correcting major deficiencies. It initiated a review of all existing MAPRW production requirements, the first of its kind. The process uncovered many targets remained on the standing collection deck well past their usefulness to the requesting units. Consequently, units flew many missions that were not required. After conferring with the army, navy, and air headquarters, the organization trimmed the deck and freed a "sizable amount" of reconnaissance capability for other taskings. From that point forward, it instituted a daily process of reviewing routine collection with the requesting organizations.[45]

MPIC also made improvements with mosaic production by scrapping a project that involved building mosaics of the entire Italian peninsula. It reviewed the task with the supported unit and discovered the mosaics "were not practical for ground use."[46] The main issue centered on poor awareness within ground units of basic photo reconnaissance capabilities and by inference poor liaison and coordination between the supported units

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and MAPRW. Based on this, MPIC placed renewed emphasis on liaisons and made a point of sending representatives to various headquarters to educate personnel.[47]

Despite this progress, problems persisted. The reform focus and the ever-increasing photo requirements admittedly diverted the organization's attention from its supported units. The issue came to a head after the breakthrough of the Gustav Line in May 1944 when frantic Fifth Army and Army Air Force requests for photo support fell short, "The advance was so rapid that the territory on which cover was required would be in Allied hands before the prints or mosaics could be delivered."[48] MPIC coordinated with Fifth Army to resolve the situation by estimating the enemy's next defensive line and focusing photo reconnaissance resources on those positions rather than the standard tactic of looking ten to fifteen miles ahead of each day's front line.[49]

This point became the crux of nearly all tasking problems during static and mobile phases; what depth should photo coverage be projected based on Fifth Army operational plans and anticipated German actions? Photo center liaisons did their best to anticipate expected Fifth Army coverage, as best they understood the ground situation. This was relatively easy during static engagements, but became increasingly difficult during mobile operations when the front lines moved at varying rates.[50] Moreover, even when attacking on a broad front, locating the frontline position with sufficient accuracy to plan missions, let alone anticipating how far the line would advance or what the Germans would do before it was photographed, proved a difficult undertaking. The sole intent became reducing the chance that ground force overran that day's coverage. Though not explicitly stated, this action would have involved close interaction between the PRU at Fifth Army and the G-3 (operations) sections.

An observer from the Army Ground Forces Board, Colonel H. J. P. Harding, visited Fifth Army in February 1944 and made several important comments on the issue. Fifth Army had a standing collection task to MAPRC to cover a strip ten miles deep across the front line every day, weather permitting. On some occasions, Fifth Army omitted coverage along certain portions of the front to permit the depth in other sectors to increase to twenty miles. The 3d Group indicated daily coverage actually extended to twenty miles or to the range of artillery on a daily basis. As for the impact on reconnaissance squadrons, by March 1944 the Photo Reconnaissance Unit established standing collection of at least three high altitude sorties per day, two of which had twenty-four inch cameras and one a thirty-six inch camera, to meet the requirements of the Anzio front. By comparison, during the same period only an additional three to four sorties per day covered all other Fifth Army demands and Army Air Force requirements supporting Fifth Army.[51]

MAPRW and Fifth Army analyzed the issue in detail, but never truly mastered the issue. By April 1944, Fifth Army estimated the basic cover requirements for a division based on analysis completed by the 36th Division. Coverage occurred along the division front to a depth of five to six miles, but this only really applied during "semi-static" situations and certainly did not cover the deeper requirements of a corps or army organization. Since divisions did not need stereo coverage, using every other print meant about twenty to thirty prints covered the entire division front. An estimated 136 sets of these twenty to thirty were required to provide sufficient quantity for subordinate units. As those who experienced it discovered, there were "no hard and fast rules."[52]

Fifth Army required coverage of more than just the immediate frontlines. Units defined tactical coverage out to fifty miles, while semi-strategic, known as operational today, covered the area from fifty to 400 miles. In addition to the frontline coverage, a typical 3d Group daily semi-strategic tasking included: eight to ten battle damage assessment targets, 1,500 miles of railroads, 150 miles of rivers, and 100 pinpoint targets. Covering these targets required approximately twenty-four to twenty-eight missions.[53]

Semi-strategic coverage provided the tactical air force and Fifth Army intelligence on the following subjects for those areas covered in figures 35 and 36:

1. Monitored strategic reinforcements and construction of defensive lines

2. Identified and located potential targets for aerial interdiction

3. Aided planning for future operations

4. Created or updated maps

Cover of these deeper areas began with basic cover during planning, and then transitioned to routine coverage at regular intervals. The frequency of routine coverage varied from several times per day to once a month based on target activity and unit requirements. The repeated cover provided information on troop concentrations and maneuvers by tracking railroad yards and supply points, and made the German task of quickly concealing defensive positions that much more difficult. This became a give and take since units that requested coverage too often unnecessarily exposed pilots to threats for little intelligence value, or they exceeded the interpretation and production capability to complete the mission before the next reconnaissance sortie.[54]
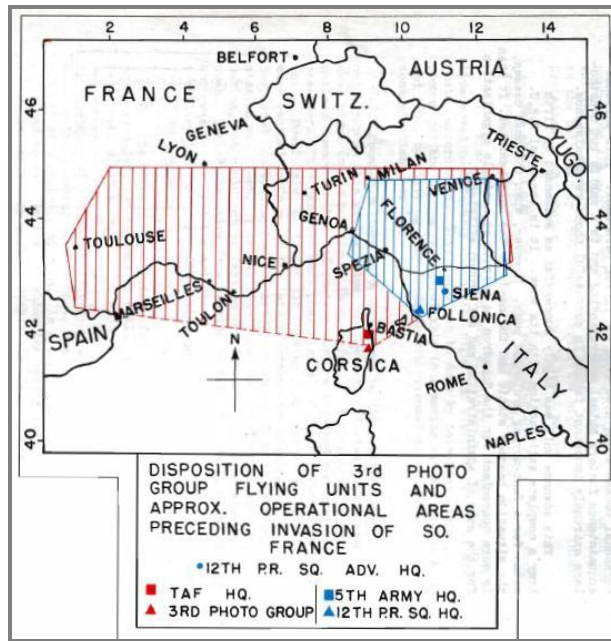
Figure 35. 3d Group and 12th Photo Squadron Areas of Coverage, Pre-July 1944
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 37.
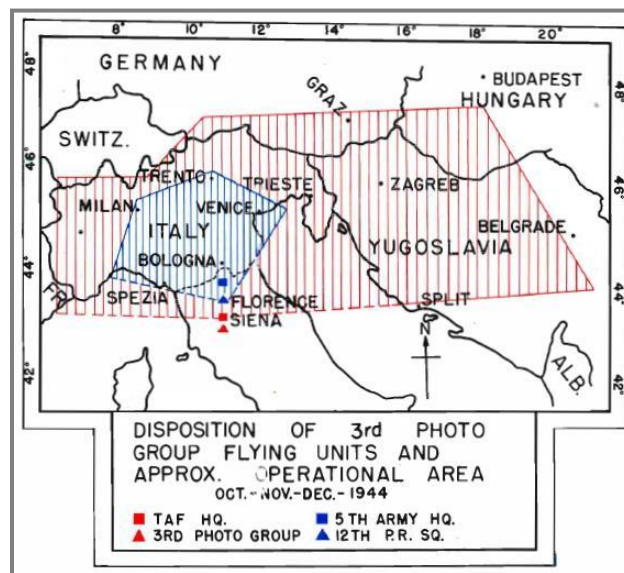
Figure 36. 3d Group and 12th Photo Squadron Areas of Coverage, Oct-Dec 1944
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 38.

As observers noted, standing collection seemed to dominate, with few urgent

requests needed. This implied the photo center and PRU effectively anticipated most

collection requirements, at least in static situations. Taskings largely resembled requests

from earlier campaigns including locations of armor and vehicles, defensive positions,

forward airfields, supply dumps, bridges, crossroads, and other key communication

points.[55] A British observer stated, "The tendency is to demand ever larger scale photos,"

and that "the question of scale will always be a compromise between the demands for

larger scales and considerations of safety of planes and supply of materials."[56] His point

illustrated the continual need to educate Army personnel to focus on the true requirement.

According to the Fifth Army and at least one observer, most photo reconnaissance

occurred within a twenty-four hour cycle from request to product in hand. By late

afternoon, the Photo Reconnaissance Unit assembled and prioritized the requirements,

then submitted them to the photo center. To speed the request cycle, at some point during

the Italian campaign units submitted all requests via phone. Since photo light generally

occurred at least two hours after sunrise and two hours before sunset, units did not fly at

"first light." Interpreters generally had photo prints by noon to begin their work, and they

normally completed reports by evening to provide the corps its set of prints by the next

morning. Each corps received enough prints to give one set per division, one for the

corps headquarters, and one for the corps artillery headquarters. By removing several

organizational layers, Fifth Army usually received interpreted photo prints within twenty-

four hours of its request. For urgent request, missions flew immediately and they could

deliver radio reports and prints to a courier in as little as three hours.[57]

Liaisons at all levels played a major role in facilitating this smooth functioning. Air Liaison Officers (ALOs) preempted many corps and division requirements because they participated in Fifth Army planning meetings and coordinated the requirements directly with the photo center and squadron. 3d Group also tasked them to work with the photo center and the squadron to select suitable airfields near Fifth Army HQ and to maintain "friendly cooperation."[58] The latter task points to the degree of progress that occurred between the organizations involved. As described by the 3d Group history:

> In the relations between 5th Army and its photo squadron, the Army, through its liaison officers, has been forebearing in errors, helpful in emergencies, and appreciative of successes. This attitude more than any other single factor has resulted in willing cooperation and complete harmony between Air Corps and Army within [the] P.R.U.[59]

From the 3d Group's perspective, the photo sections at the corps and division headquarters helped immensely in clarifying demands, expediting their delivery up echelon, and assisting in distributing post-mission products. As an example of the effective operations, with the Anzio beachhead in jeopardy on 16 February 1944, ground reports indicated German tanks had massed near Cisterna. An immediate call to the 12th Photo Squadron got an aircraft in the air within an hour, and photos later revealed an entire panzer division prepared for an attack. This unit, the Hermann Goring Division, launched a feint attack near Cisterna that same day. Knowledge of the enemy forces allowed the 3d Infantry Division to repulse the attacks with artillery.[60] As later highlighted by the 3d Group, "The main purpose of the whole set-up is SPEED."[61]

Tactical reconnaissance tasking also evolved with the experience in Italy and differed with the field manuals of the period; primarily by centralizing it under the Fifth Army G-2 section. The G-2 (Air) section received tactical reconnaissance and artillery

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adjustment requests, determined priorities, and coordinated missions with the Tactical Air Command (TAC). The TAC allotted missions to Fifth Army at which point the G-2 (Air) worked directly with the tactical reconnaissance squadron. The number of missions allocated to Fifth Army varied based on frontage, the number of corps, TAC needs, and the degree of mobility.[62] Mobile situations required more missions to track enemy movements whereas photo reconnaissance could better cover static operations.

Centralizing collection management under the Fifth Army G-2 (Air) had several advantages. It permitted integration and deconfliction with photo reconnaissance, and allowed verification of other sources, especially prisoner interrogations, when needed. Consolidated requests prevented corps and divisions from submitting conflicting or poorly prioritized requirements to the reconaissance squadrons. The G-2 (Air) officer attended the air observer's course, and therefore understood the basic capabilities and appropriateness of tactical reconnaissance. Finally, Fifth Army could better integrate tactical reconnaissance with fighter-bombers and armed reconnaissance missions to provide maximum air response to any significant activity observed.[63]

The G-2 (Air) contacted the squadron directly to coordinate taskings and to clarify details on Fifth Army's intended operations. A subseqent notification to the TAC allowed the TAC to confirm the tasking to the squadron with a written directive. This significantly reduced the layers of coordination between the ground and reconnaissance units. By comparison, in France and Germany, each Army level G-2 (Air) coordinated taskings with the TAC and its reconnaissance group. The army-squadron relationship in Italy permitted easier liaison, but ran counter to the general notion of centralized control of airpower learned in North Africa. Communication systems greatly facilitated this

direct liaison. The G-2 (Air) maintained teletype and phone connectivity with the squadrons to pass immediate adhoc taskings and keep the units updated on the ground situation. The G-2 (Air) even had the ability to contact pilots during a mission to dynamically retask the pilot while in flight, something executed several times in the May 1944 Operation DIADEM.[64] Fifth Army concluded, "This close coordination between Army headquarters and the air force [on tactical reconnaissance] produced excellent results."[65] In addition to the communication, ground liaisons officers with the squadrons provided information and clarification on the ground situation, helped brief and debrief pilots, and reported collection results.[66]

Collection

Italy's terrain posed a significant operational challenge throughout the campaign. As a result, units generally flew missions from 1000 to 1400 hours to reduce the effect of terrain shadowing. In some extreme terrain, missions had to be flown at noon for that reason. This not only confined observable activity to a small window of time, but also made the general coverage times predictable and therefore more risky. A post-war report concluded "the rugged, wooded terrain and the skeleton-type of rear-guard resistance employed by the Germans made it difficult for the bombers--and difficult even for the tac/recce planes--to locate good targets."[67]

Sources revealed repeated references to weather difficulties throughout the Italian campaign. Weather was "by far the most important consideration," and received hourly checks. It seemed to cause the biggest problems for high altitude photography during the winter months. When rains turned the dirt airfields into mud, flight operations became challenging and only those airfields with concrete runways could operate. Even when

pilots did get airborne, good or bad weather in the morning might not hold into the afternoon and therefore prevented or allowed missions respectively. In some cases clouds obscured everything, while at other times they covered just the target. Pilots often would not know the weather for certain until they reacehd the target area, and even then sometimes not until interpreters examined the film.[68]

Though it is impossible to completely reconstruct the true impact, a few highlights help illustrate the point. In October 1943, 201 of 345 NAPRW missions were fully or partially successful. Of the 144 unsuccessful missions, weather affected 80 percent while enemy actions affected only 3 percent. Poor weather from 15-28 November 1943 cancelled all fights on eight days except for a few crucial reconnaissance missions. In late September and early October 1944, aircraft faced an extended period of foggy and rainy days. [69] "Six days of November [1944] were listed as good, ten were fair, ten poor, and four had zero visibility as low fogs hung over the mountains. On only nine days of the month were reconnaissance planes able to take pictures." [70]

To overcome the weather, squadrons employed a number of different tactics. Pilots sometimes dodged clouds to photograph targets, but this risked running into the rugged terrain. 12th Photo Squadron pilots had to use caution when using holes in clouds as First Lieutenant D.F. Toomey discovered. After revisiting the same hole one too many times, "all hell broke loose--every gunner in the area must have been waiting for me because the air around me literally exploded with flak."[71] Depending on the cloud ceiling, tactical reconnaissance F-6s performed lower altitude missions, usually 6,000-10,000 feet, to provide limited photographic coverage on those days. The mountains made those missions particularly hazardous and must have forced deep consideration on

which areas truly needed coverage despite the bad weather.   Units sometimes employed wider angle lens cameras under the cloud ceiling to maximize area coverage. However, the resulting increase in threat exposure permitted fewer and shorter runs over enemy territory. Finally, without satellites and sophisticated weather forecasting tools, units relied on debriefs and radio calls from various MAAF units for weather updates. In some cases these reports determined mission feasiblity if the weather looked poor. [72]   It is possible German radio broadcasts also provided a source of weather information.

Even with bad weather, missions sometimes still flew due to the overriding need for intelligence or the hope that the weather would improve. The sizable number of unsuccessful missions due to weather indicates this occurred routinely. For example, on 19 April 1944, First Lieutenant Toomey flew a weather reconnaissance mission that also doubled as a photo reconnaissance mission "to grab whatever targets of opportunity I could."[73] Despite the bad weather in late 1944 and early 1945, reconnaissance units still managed to obtain photos on average four days per week. During the spring 1945 Po valley campaign, the entire area to include lines of communication received complete coverage every ten days despite poor weather.[74]

While weather served as the largest variable, German defenses still posed an obstacle. Though not often present, enemy fighters forced pilots to return to base or hide in the clouds before reattempting a photo run. Flak remained largely inaccurate, but affected the efficient coverage of targets since pilots could take little evasive action without significantly distorting the picture.[75] Through January 1944, post war analysis concluded "the enemy made strenuous efforts to prevent Allied photo reconnaissance."[76] After that, German fighters gradually decreased as a major threat.

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To further reduce the enemy threat "all of us devised little tricks to confuse the enemy gunners and evade flak."[77] This included making multiple false start runs on a target area from different directions, or entering a shallow dive and increasing power when they received flak to complicate the gunner's targeting.[78] Pilots collected a few higher priority targets early in the mission to salvage at least a portion in case the mission aborted, and they varied routes and times from day-to-day to be less predictable. Finally, pilots stressed the importance of avoiding vapor trails by using rear-view mirrors. Staying just under the vapor trail altitude forced ground anti-aircraft gunners to use less reliable radar, and if an enemy fighter got above the reconnaissance plane, the adversary's contrails would reveal his presence. During the winter, colder temperatures lowered the vapor trail altitude and forced pilots closer to the threats. Winter altitudes were usually 18,000 to 20,000 feet, while summer altitudes allowed operations at 25,000 feet and higher that reduced the threat.[79]

A glimpse at May 1944 provides some perspective on the level of effort provided. MAPRW flew 994 missions, of which 924 were successful. Weather and mechanical failures accounted for 65 and 18 percent respectively of the seventy unseccessful sorties, while confirmed or possible enemy action accounted for just 10 percent. At the same time, the photo reconnaissance squadrons averaged 30 percent understrength in pilots and aircraft, even in the spring of 1944. Details on the shortages are not clear, but losses according to the same source amounted to less than 1 percent.[80] Therefore, this most likely represented the strategic shift away from the Mediterranean to France as the Normandy invasion neared.

The 12th Photo Squadron mostly flew mapping or pinpoint targets, with mapping missions the majority, and very few "dicing" missions. Mapping missions included both area and strip coverage, and usually entailed five to seven parallel lines, each three to five miles apart with a length of thirty to forty miles. From 25,000 feet, pilots usually employed twelve or twenty-four inch focal length cameras. If the pilot achieved 100 percent coverage, a rare feat, a single mission could cover 400 to 500 square miles. Mapping missions exposed pilots to an even greater risk than pinpoint targets given the relatively predictable flight lines and greater flak concentration, though they tended to be shorter and cover areas just behind German lines. Pinpoint targets involved a "multitide of relatively isolated, single areas of interest, such as bridges, tunnels, highway intersections, etc."[81] These usually required only three to four exposures, but pilots needed precise navigation to reach each target.[82] Figure 37 illustrates a typical 12th Photo Squadron mapping mission from the resulting coverage strips (note the relatively parallel lines). Figures 38 to 40 show a typical pre-mission plan to cover pinpoint targets, and the associated post-mission pilot sketch and debrief report.
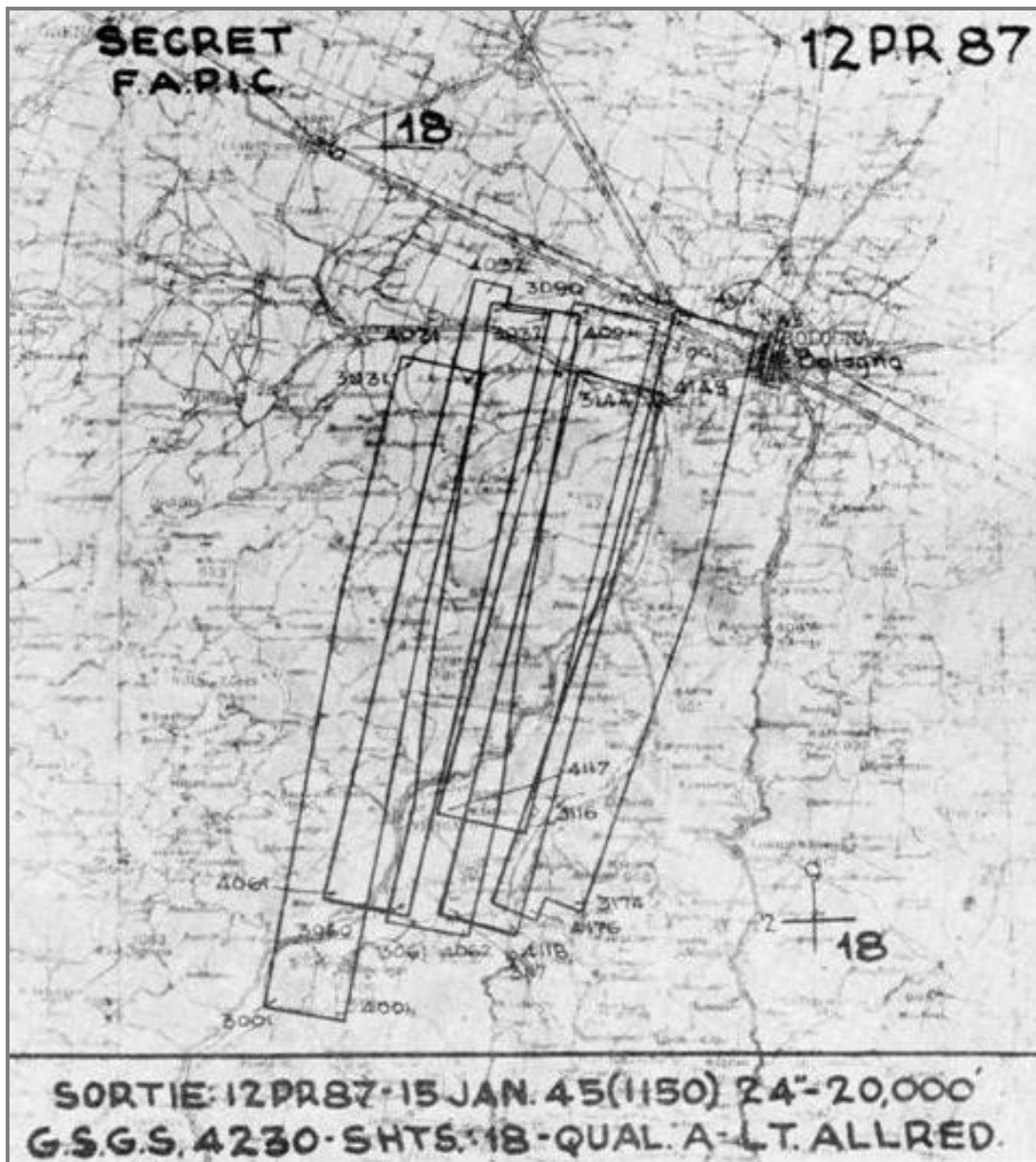
Figure 37. Photo Mapping Mission Coverage Strips
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 25.
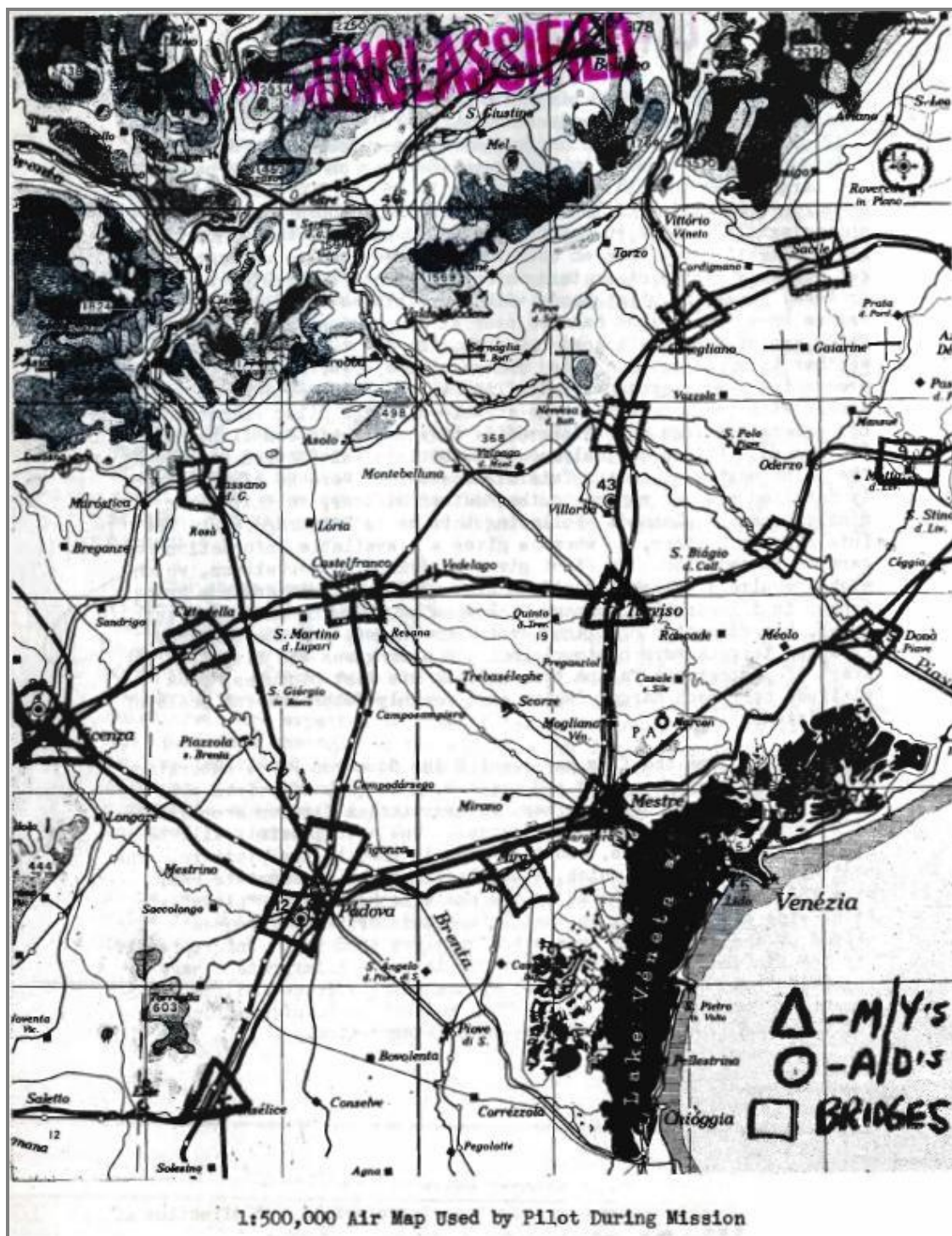
Figure 38. Lieutenant Des Voigne's Photo Reconnaissance Pre-Mission Plan
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 13.
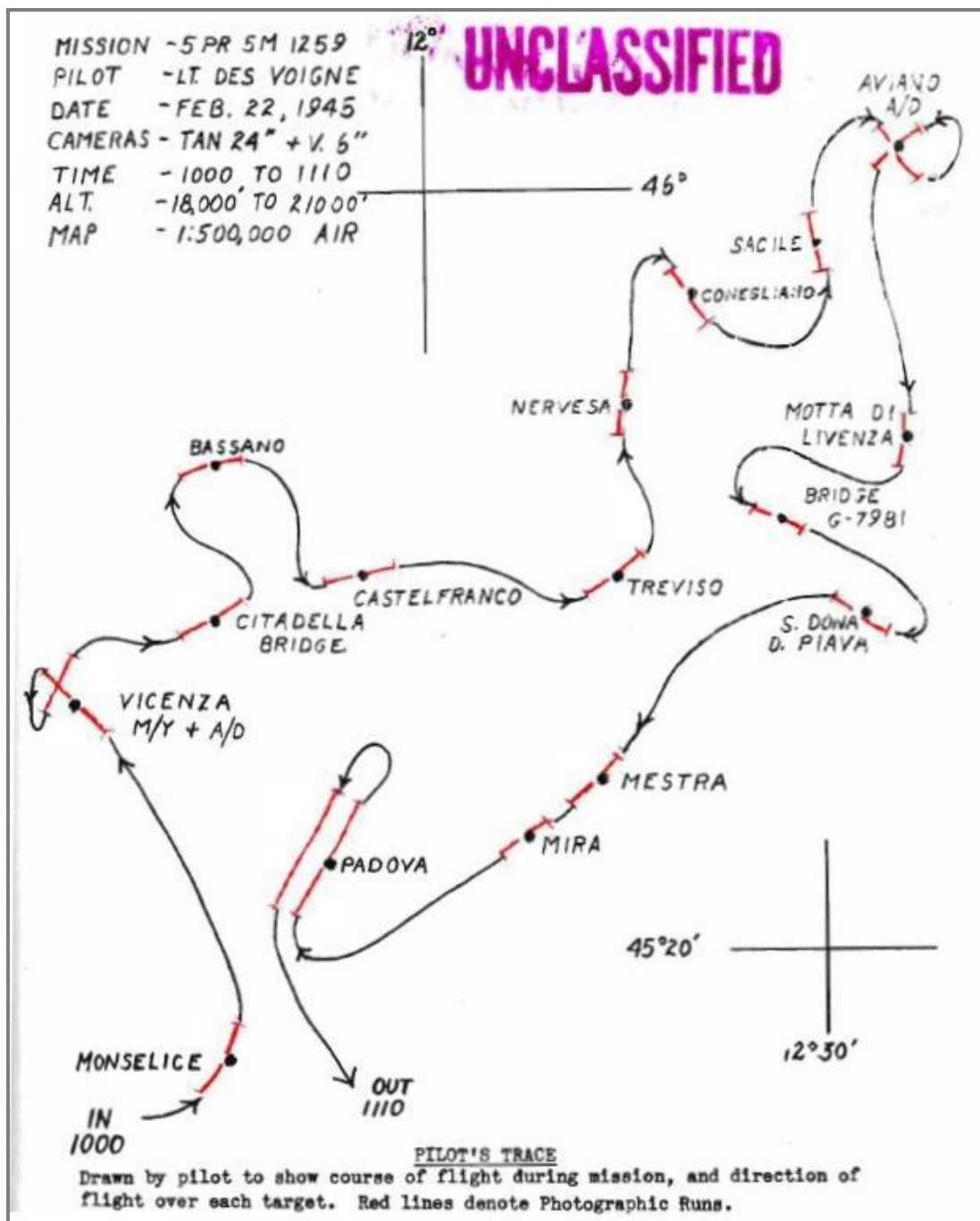
Figure 39. Lieutenant Des Voigne's Post-Mission Pilot Trace
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 14.

Sortie No. 5PR-5M-1259	UNCLASSIFIED	Date: Feb. 22, 1945		

Pilot:
Observer: Lt. Des Voigne   Time Out: 0900   Time in: 1150

Squadron: 5th P.R.Sq.   Total Time: 2 hr. 50 min.   E/A: Possible

Aircraft No. 44-24727   Flak: Yes

Target Weather: Clear to overcast at 19000'
5/10 middle clouds in NE   Tanks Dropped:

Targets and Reference Number Covered or Not	Briefed Yes – No	Time	Alt.	F/L	Remarks: Visual – Flak – E/A – Shipping, Etc. If Targets Not Covered Give Reasons
Monselice M/Y's	Yes	1000	18000' 21000'	Tandem 24"	Overcast at Monselice and Padova at 1900' Targets in shadown.
Vicenza "					
" A/D					
Citadella Bridge					
Bassano "				&	
Castlefranco Bridge					
Treviso M/Y's					2 unidentified S/E A/C seen at Treviso at 15000' heading 30 degrees. No attack.
Nervesa Bridge					
Conegliano "					
Sacile Bridge		to		Vert. 6"	
Aviano A/D - 2 runs					
Motta di Livenza Bridge					
Bridge at G.7981					Approx. 50 bursts of very accurate flak at Mestre. Plane holed in 3 places in right boom. Did not affect operation of plane so pilot continued and got pics of last four targets.
S. Dona di Piave Bridge					
Mestre M/Y's					
Padova Bridge					
" M/Y's			19000'		
Padova So. Bridge		1110			
Not covered due to weather					
Belluno M/Y's					
					C.W.HAINES Capt., Air Corps Interrogating Officer.

Figure 40. Lieutenant Des Voigne's Post-Mission Debrief Report
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 15.

With the shortage of people and aircraft, every mission "counted" in that sense.

Pilots deserved enourmous credit for the successes attained. The 3d Group had certainly

perfected collection tactics with an emphasis on navigation, parallel flight lines, scanning

the skies, and taking pictures at the correct interval. More experienced pilots tended to

receive missions with fewer checkpoints, while those with better checkpoints went to

newer pilots. To start a photo run, pilots chose references from the map and ground then flew a straight line, all the while correcting for wind drift, keeping the plane level, and watching for threats. First Lieutenant Toomey stated that due to the many activities that diverted attention, "it was easy to drift off your flight lines . . . [which] meant that there would be gaps between exposure strips which were voids for the interpreter back at the lab."[83] To further illustrate the difficulty, Toomey flew sixty-three combat missions, yet he only achieved 100 percent coverage on six missions. Pilots often revisited suspected gaps with any remaining film. In fact, some future missions became little more than cleanup of coverage gaps from previous missions.[84]

Even in 1945, the 3d Group stated in its unit history that "very few pilots are trained for army work--that is, flying a series of parallel lines for a mosaic."[85] From the group's perspective, training focused more on pinpoint targets and strips, skills more valuable for supporting Army Air Force related targets. Each pilot required additional training in the squadron to build this skill. Although the unit's collective experience had improved, losses and transfers back to the United States and to other organizations forced units to deal with an influx of replacement pilots. Therefore many front line pilots had to devote additional attention to providing on-the-job training, essentially mission qualification training. To further impart an understanding of the work they performed, pilots routinely visited the divisions to better understand the ground unit perspective, build relationships, and learn tips to improve their techniques.[86]

As allied aircraft continued to dominate the air, German movements became very limited during the day, and major movements moved to darkness. When questioned about whether his units fired on spotter planes during the day, a German soldier replied,

"Yes, but quite suddenly two of them would turn up and give you a burst of machine gun fire and then disappear. Later twelve fighters and two recce planes would appear and you wouldn't know where to turn first . . . All we could do was to take cover."[87] The same soldier later commented, "It was impossible to to move behind the front during the daytime. We could only do it at night."[88]

In response, MAPRW continued efforts to provide night aerial reconnaissance. By early 1944, units were experimenting with a new night capability, the Edgerton electric flash system. In principal, this worked the same as a flash on a modern camera and thus replaced the flash bombs. The only limitation became the number of film exposures, approximately 180. While still limited to pin point target coverage, night photos revealed major movements at marshalling yards and crossroads that exposed German intentions. Analysis revealed that supply points tended to be close to railroads and that movements largely occurred between sunset and 10:00 pm.[89] Night missions continued in Italy to uncover German movements and resupply, but not without issues:

> The only hitch was that the plane had to be flown straight and level going down the highway, all the while the big flash attachment [Edgerton Flash] going off every four to five seconds. It meant that every Kraut within rifle range got to take pot shots at you as you flew by.[90]

With the low altitudes they flew at, this presented a difficult situation. The 12th Photo Squadron's night pilot, Captain Frank Lazzeroni, indicated "there wasn't a night [that] went by that he didn't take hits."[91] In addition to these limitations, by 1945 the 3d Group only had two B-25s and one A-20 to perform night missions.[92] The Fifth Army found night photos taken of the "battle area were disappointing," though it did have uses in detecting movements in rear areas.[93] It is doubtful night photography had a major effect.

Another significant challenge remained keeping pace with Fifth Army's advance

when German units retreated to their next defensive line. While the 3d Group had

supported mobile operations in Sicily, the length of the Italian peninsula forced regular

relocations of reconnaissance units to maintain relatively close contact with the army and

corps headquarters. Just after the Salerno invasion, the 5th Photo Squadron split into two

elements, the first composed a small section of fifty personnel that set up forward

operations in Pomigliano, Italy, near the Fifth Army HQ at Salerno, while the second

echelon continued operations from Tunisia until such time that it could move forward.

The forward unit did not start operations until 6 October because the transit lasted longer

than expected. This greatly strained the two interpreters and engineer left behind in

Tunisia, and in some cases caused delivery delays of forty-eight hours.[94] Sometime later,

the entire photo center and Photo Reconnaissance Unit relocated as well.

After the Anzio invasion, the 12th Photo Squadron detached three aircraft and the

necessary production facilities to Anzio to maintain close contact with the VI Corps.

This unit maintained contact with the Fifth Army PRU via courier planes and radio.

When the Fifth Army reached the Anzio beachhead, the photo center rejoined the

detachment at Nettuno airfield near Anzio. As it continued north, PRU personnel

realized the distance from Anzio prevented effective communication with ground units.

While air liaisons helped, interpreters needed current information on the enemy situation

and the reconnaissance unit had to be with the range of liaison aircraft for courier flights.

The PRU needed to move to keep pace with the Fifth Army HQ.[95]

Using the Anzio model, leapfrogging units became an important aspect to support

mobile operations in Italy. The PRU once again created a detachment of three aircraft, an

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air liaison officer, and the necessary production facilities, and directed it stay within "easy distance" of the Fifth Army HQ during mobile situations. Being so light, the unit easily moved with twenty-four hours notice, but it only provided three sorties daily for strip coverage of the frontlines. The close proximity allowed air liaison officers to visit the G-2 for the latest on the battlefront before flying missions. With that knowledge, the unit typically planned to finish sorties by 1030, which provided initial reports to the corps by early afternoon. By 1700, corps liaison planes picked up any available prints, and artillery began firing on targets by 1800. Interpretation continued through the night until the next day's missions began. Meanwhile, the photo center provided bulk production and deep area coverage of Fifth Army operational and strategic areas. Once mobile operations gave way to static defenses, the photo center relocated to the forward airfield and reabsorbed the detached unit.[96]

The forward units helped keep the coverage and interpretation relevant to that day's advances, and the close communication often overcame Fifth Army's nighttime advances. Another important tactic further enhanced this capability. Rather than fly a sortie for each corps, which necessitated serial film development and interpretation, the 12th Photo Squadron planned missions to cover a portion of each corps. This permitted parallel interpretation of portions of all Fifth Army corps areas. With the focus on counter-battery intelligence, this tactic permitted the quickest dissemination of information to overcome German artillery's daily movements. On a static front such as Cassino, prints usually did not reach the corps until twenty-four hours after being photographed. While acceptable then, this could not support a mobile fight. In an age before digital images and high-speed communications, corps artillery units regularly

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received photos within five hours during the rapid drive from Cassino to Pisa. As a result, a close relationship developed that provided the basis for mutual respect and understanding.[97] In contrast, during the rapid advances following the capture of Rome, the Fifth Army only needed coverage of major roads, with six sets per road strip at 1:25,000 scale. Efforts to provide mosaics of the surrounding terrain at 1:25,000 scale "of the area North of ROME just failed to keep pace with the advance."[98] While smaller scale photos offered a possible compromise with greater area covered per exposure, they lacked the detail to be of great use outside of general terrain orientation.

Based on these techniques, the 12th Photo Squadron made five moves in Italy as the forward unit attempted to stay near Fifth Army and within fifty miles of the front. While supporting operations against the Gustav Line, Lieutenant Toomey flew a mission while based fifty miles from the front and noted "when I finished my last run I could actually see our runway."[99] After moving from Pomigliano to Anzio, the unit moved on 19 June 1944 to Voltuno (or Tarquinia), fifty miles north of Rome as the Germans quickly retreated north. On 15 July the squadron consolidated at the next location, Folloncia, about 100 miles northwest of Rome. After moving to Cecina, roughly 150 miles northwest of Rome, the unit relocated its final time to Siena, about fifteen miles south of Florence, on 22 September. From here, it was only thirty miles south of the German positions along the Gothic line.[100] The close proximity certainly increased timeliness by decreasing flight times, and allowed better coordination with Fifth Army. Once again, MAPRW permitted techniques that contradicted the idea of centralization, yet it did solve the problem. Since a field army had a much broader mission than a

division, in theory it had sufficient requirements to keep an entire photo reconnaissance squadron gainfully employed in any situation.

Tactical reconnaissance missions from the 111th Tactical Reconnaissance Squadron helped fill several collection voids. Until NAPRW relocated from Tunisia, "this situation [time delay] was partly alleviated by having a supporting tac/recce squadron make a number of pin-point photos."[101] The 111th provided most of the oblique shots of beaches, riverbanks, and hill features that planners used for future operations, both at the tactical and operational level. Obliques helped verify small trails located on vertical photos, but interpreters had difficulty using them to locate defensive positions due to their viewing perspective. By mid-1944, distribution of obliques occurred down to the platoon level.[102]

The F-6s flew anywhere between 3,000 and 10,000 feet, though usually at about 6,500 feet. At lower altitudes the ground passed to quickly for complete reports. Through experience, Fifth Army learned to use these aircraft against "readily seen movements" such as formations on roads or railroads, roadblocks, bridges, and large caliber guns in the act of firing.[103] Pilots had great difficulty locating equipment near treelines or correctly camouflaged. They also offered the ability to photograph smaller targets, especially when weather precluded high altitiude missions by the F-5s.[104]

The increased interest in obliques from the Fifth Army brought a similar emphasis within the 3d Group. The process of obtaining these involved extensive experimentation to balance the focal length, area covered, detail provided, and minimize the pilot's risk. Using the standoff capability of oblique cameras, units understood obliques worked best in the following conditions: linear features such as coastlines, ridges, rivers, or defensive

lines. They also learned the types of oblique requests they could not satisfy, those where

pilots had to fly between two hills, and missions deep in enemy territory or too inland.

When the front reached the Arno River in July 1944, the threat greatly reduced when the

12th Photo Squadron switched from a twelve-inch to a twenty-four inch oblique camera,

which permitted standoff from two to three miles at low altitude.[105]

Interpretation

The photo center and interpreters at subordinate echelons served as the focus for

all exploitation (see figure 41). These elements served not only to interpret photos, but

also to coordinate demands and delivery of products from higher echelons. In many

cases, personnel from these elements worked directly with ground commanders once they

had earned their trust and established their competence. The photo center stayed close,

usually collocated, to the 12th Photo Squadron operating airfield to reduce the time in

getting prints to the interpreters to less than three hours. As a result, they had quick

access to pilot traces and debriefs as they conducted their exploitation. These products

oriented them to the area covered and in some cases permitted research prior to the prints

arriving.[106] (see figures 39 and 40 above)

The photo center had several sections to divide the workload. The tactical section

provided first phase interpretation focused on artillery targets and counter-battery fire.

The strategic section provided second and third phase analysis of rear area defenses and

created map and photo overprints that detailed everything down to foxholes. A third

section handled intelligence fusion between photos and other sources, along with target

nominations. Resident "Air Support experts" identified and prioritized targets for aerial

attack, while other personnel immediately passed each artillery gun located by radio to

the corps artillery for attack. This timely information often permitted same day attacks

on targets, in some cases in less than six hours from being photographed. Finally, the

engineering section focused on terrain and lines of communication for suitable travel and

serviceability. Rivers received a great deal of attention including detailed descriptions of

the bank height, and possbile fords and bridging sites.[107] Figure 42 shows a typical photo

interpretation report the photo center produced from the mission flown in figure 37.
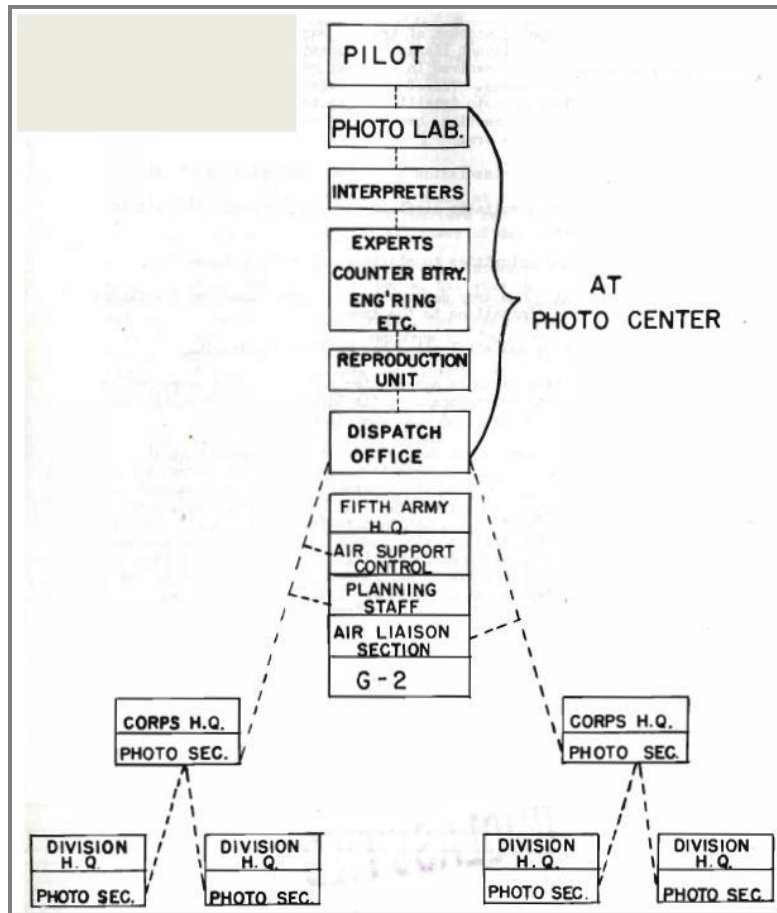

Figure 41. Flow Chart of Film from Collection to Division
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 33.

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                    GENERAL INTERPRETATION REPORT NO. P. 197

SORTIE USED:

Sortie    Unit      Pilot        Time   Date    FL   Scale     Quality
12PR 87  12PR Sqdn. Lt Allred     1150  15 Jan  24"  1:10,000    A
Covers:  A block over Highway No. 64 from VERGATO (L 6926) to BOLOGNA.
         Area L 6317 - L 7049 - L 8850 - L 7821

                          GENERAL NOTE

      Except for an overall increase of approximately twenty-one field guns
of light calibre in a general area south of BOLOGNA, no other change has
taken place to the field artillery situation.
      Little military activity and hardly any movement is seen in the areas
covered by the above good quality sortie which was flown over the most
important sector of the tactical front.
                     -------------------

I.   FIELD ARTILLERY
      a)  POSITIONS OCCUPIED

1.    87/111SE   L 73173781   3/4 field bty.          12PR87  3045 D447
2.    98/IVNE    L 67402820   3, possibly 4 gun field bty.
                                                     12PR87  3011 A334
3.    87/111SE   L 69193447   1, possibly 2 light guns, type unknown.
                                                     12PR87  4018 D853
4.               L 69173543   4 light guns, type unknown  "     "  E234

      b)  POSITIONS UNOCCUPIED

1.    87/111SE   L 75303683   4 gun field bty unoccupied 12PR87  4077 C631
2.    87/11SW    L 83553700   2 unocc gun emplacements. 12PR87   3159 D962

                    *  *  *  *  *  *  *
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Figure 42. Fifth Army Photo Center Interpretation Report
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 26.

        By June 1944, each Fifth Army corps and division had an interpretation team of

two officers and two to three enlisted men. Some divisions even included interpreters in

their artillery section to minimize the time delay. The corps and divisions usually

received a set of that day's photos via courier plane, from which they performed second

phase exploitation. Divisions often had same day coverage and interpreters there had

access to the most current information on division operations and intelligence from unit

patrols and interrogations. Photographs became an important source to confirm

information derived from civilians and German prisoners, and for briefing ground patrols.

This proved very lucrative with about one in three ground reports confirmed on aerial

photos. Interpreters from division, corps, army, and the photo center maintained close

communication with each other and regularly passed information on activity observed.[108]

In fact, the division performed the bulk of the exploitation to an agreed upon depth for its

front and the photo center more general coverage; the corps fused the results between

both organizations and built the overlays used with maps.[109] However, at least one

observer noted an underutilization of the interpreters:

> Most units in the theater apparently failed to release the full value of aerial
> photos, little use being made of them other than the study by the corps and
> division PI sections. The 88th division used photos more than any other unit I
> have observed, issuing sets down to regiments and artillery battalions.[110]

While only one point of view over a limited two-month period, it does point to possible

wider problems concerning the full employment of photo interpreters.

Terrain features greatly hindered the ability of interpreters. Aerial reconnaissance

of the Gothic line in northern Italy encountered significant terrain difficulties:

> Many of these hills were covered with pine forests which made it more difficult to
> locate enemy defenses by air photos, and the Germans were thorough in
> camouflaging the results of their work. Small underground fortresses were
> constructed by boring shafts straight down, excavating rooms for personnel, and
> then running tunnels for machine guns out to the face of the slopes. All spoil was
> taken out through the shaft to be disposed of well away from the position, and
> since no digging had been done near the firing apertures they were extremely
> difficult to locate even at close range.[111]

Even with the best equipment, some activity and equipment remained elusive. Despite

using thirty-six-inch cameras at 22,500 feet to obtain 1:7,500 scale photos, "it is difficult,

if not to say impossible, to find gun positions in certain types of country in ITALY,

where the country is mountainous, broken and heavily wooded."[112]

In addition to the terrain, interpreters faced increasing difficulty with German

camouflage efforts. Major Fuglesand remarked, "The enemy has become very conscious

of our photographic activity, and is at great pains to camouflage his battery positions."[113]

In fact, a captured German document stated:

> The up-to-date cameras used in photographic reconnaissance register all the mistakes we make in the construction of positions. They are accurately transferred on to the enemy's artillery maps. The defenses are accordingly made known to the enemy, and can be bombarded at any time, even though they may be subsequently perfectly camouflaged.[114]

A German 19th Luftwaffe Field Division order repeated a similar theme:

> Enemy aerial reconnaissance detects our every movement, every concentration, every weapon, and immediately after detection smashes every one of these objectives. This is accomplished by a close coordination of Air Force and Artillery. Every soldier must be made to realize that the enemy's present superiority in the air is not of temporary duration--subject to time and location-- but rather that it is a part of a permanent set of conditions that must be faced by our troops. Experience demonstrates that the enemy knows how to reconnoiter and destroy our every concentration. Every weapon detected by the enemy is destroyed by coordinated fire, directed by his OP's. The enemy can conduct his artillery reconnaissance observation completely unhindered. Every vehicle must post an air look-out. The best means of locomotion for individuals, as well as whole units, is the bicycle. To find appropriate cover with lightning speed, practice is necessary. More than ever before, units must be trained fully to master the art of camouflage. It is not enough that soldiers know how to attach grass and twigs to their helmets. Complete camouflage of men and material is required.[115]

Finally, a German document from Supreme Command, Army Group B stated, "Everywhere the troops will employ camouflage, and at every halt they will dig in deeply (troops, weapons, and vehicles)."[116] Interpreters countered camouflage tactics through frequent use of previous photos for comparative coverage to distinguish even minute changes in activity.[117] Yet despite intense efforts to uncover German positions in the Gustav line in early 1944, extense camouflage thwarted many attempts and "managed to keep much of their firepower from being detected or destroyed from air attack."[118]

Figure 43 shows some of the extensive efforts German units used over a twenty-four hour period to cover their crossing of the Po River in late December 1944.
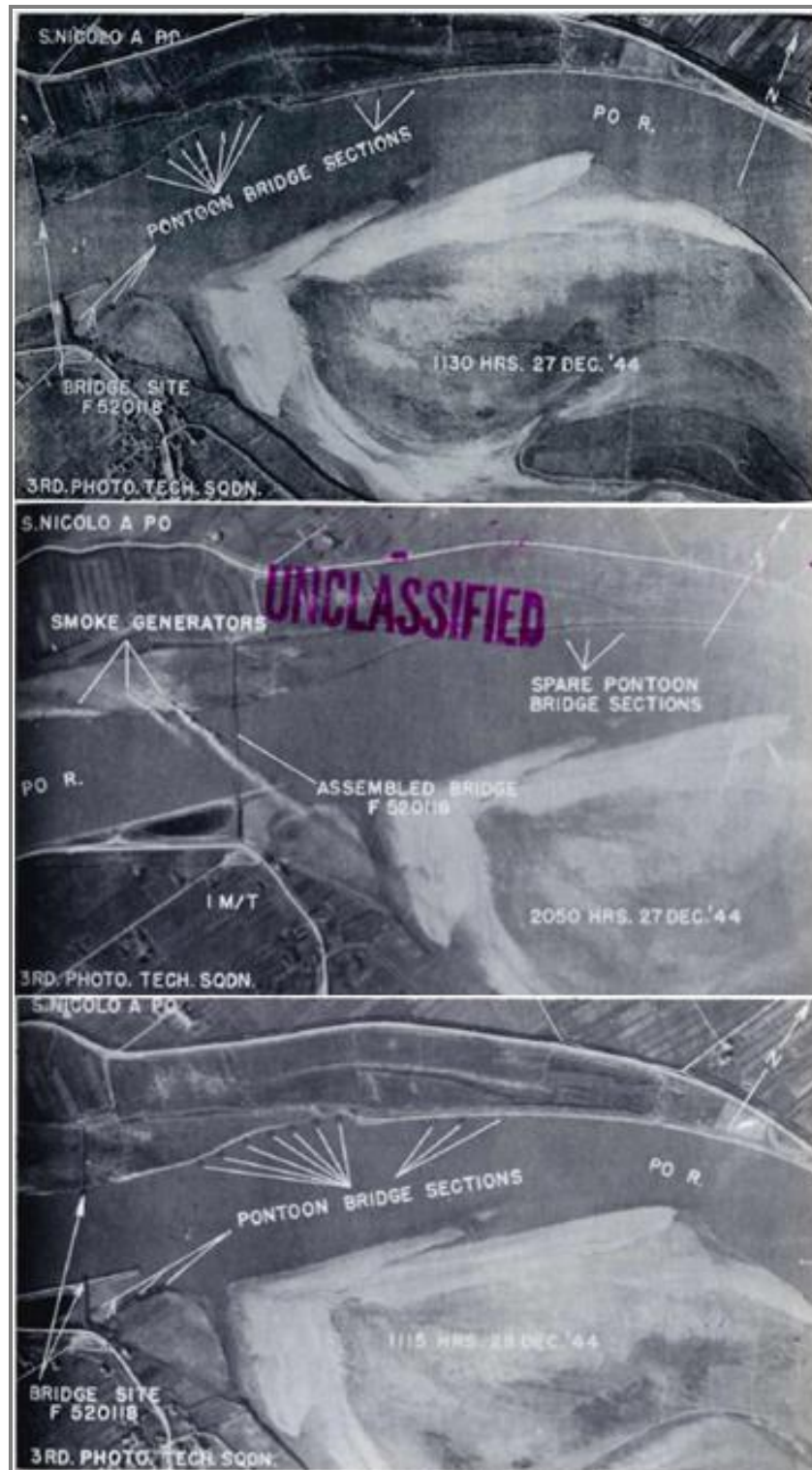
Figure 43. German Deception on Po River as Revealed by a Series of Day, Night, and
Day Photos Over a Twenty-Four Hour Period
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 69-70.

During static phases, the additional time allowed detailed exploitation and application of the photos that helped overcome the terrain and camouflage difficulties to a degree. Fifth Army G-2 had personnel plot intelligence from photos and other sources on maps and photos in different colors for easy differentiation and dissemination out to subordinate units. An Army Air Force observer noted that of the overprinted maps he viewed, "Approximately 80% of the information is shown in red [meaning derived from aerial photos]."[119] This technique distinguished information from other sources such as interrogations or signals intelligence, served as a very primitive common operating picture for situational awareness, but it required constant vigilance to maintain any semblance of accuracy. Some corps and divisions applied elaborate overlays and grids to assist subordinate units in locating key ground features, enemy activity, phase lines, and even neighboring units. Interpreters had to balance between aiding the layman and unnecessarily cluttering the photo and adding time to the process.[120]

Interpretation did not focus exclusively on fielded forces, but on lines of communication, cities, airfields, and ports as well. As an example, in November 1943 NAPRW completed a comprehensive study of the area between 43ºN and 44ºN for planning staff use. NAPRW finished a follow-on report for 44ºN to 45ºN covering roads and railways in and out of towns, and the status of harbors and quays. Harbor information allowed planners to determine the number and type of ships it could support, and the infrastructure available to unload ships. Similarly, airfield and landing ground data provided information useful to support parachute or glider drops as shown in figure 44. Finally, the report provided extensive details on defensive positions noted in the

area.[121] While enemy forces could certainly move, German units tended to optimize

positions based on terrain features; therefore, positions likely did not change extensively.
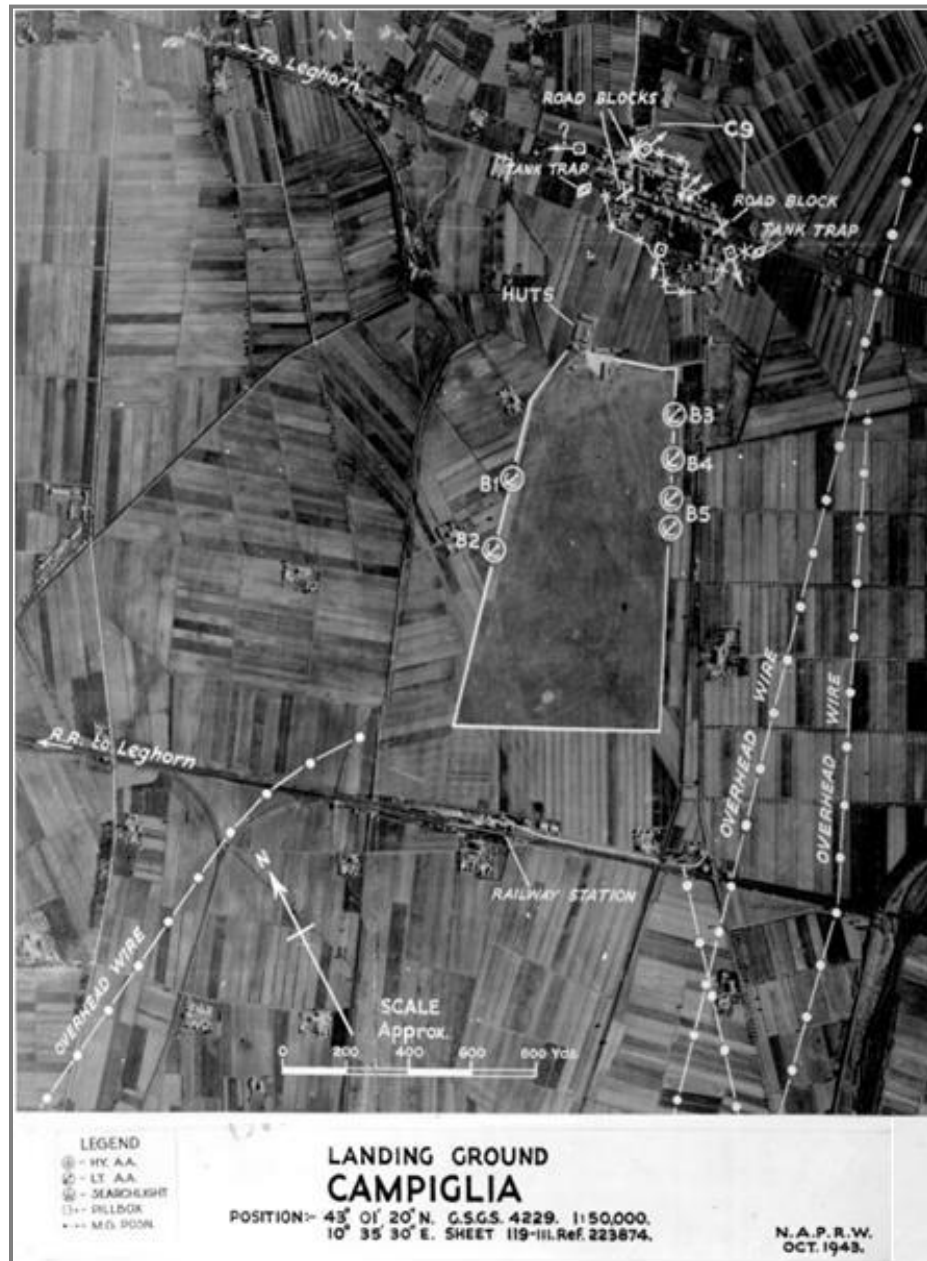
Figure 44. Basic Cover of Northern Italian Airfield for Planning Purposes
Source: Northwest African Photographic Reconnaissance Wing, *N.A.P.R.W.*
Interpretation Report - Q.1, November 1943, (1943), photo B-2.

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Dissemination

The best photo reconnaissance in the world did not serve a purpose without reaching the supported ground units. As one British observer noted, "The machinery for the supply of air photos is not designed to cope with the numbers which are often demanded."[122] To provide greater mass production capability, MAPRW and the 3d Group established the 3d Photographic Technical Squadron (PTS) "out of necessity, and experience learned from the first year of the War."[123] Located with MAPRW and the 3d Group, this unit produced 300,000 prints per month. A mobile laboratory detachment from this squadron, known as the "Blue Train" for its characteristic blue trailers, served under the Fifth Army photo center, and had a capacity of 500,000 prints per month. Additionally, the 12th and 5th Photo Squadron laboratories could each produce another 100,000 prints per month. Collectively, these four organization furnished Fifth Army with a potential of one million prints per month.[124]

Medium and large-scale cover usually comprised the bulk of photo production. The latter proved the most tactically useful by disclosing individual gun and defensive positions for artillery targeting, with scales from 1:8,000 to 1:13,500. In addition to disseminating prints and reports, squadrons also sent coverage "plots" via maps or sketches to all theater commands. This ensured general awareness of available coverage and allowed ground units the ability to request prints of areas of interest.[125]

Dissemination of photographic products was the critical part in closing the loop with the requesting unit, yet as Major Fuglesand identified it is "one which is usually most overlooked."[126] While collocation with Fifth Army HQ resolved the problem for that echelon, the reconnaissance units, except for the forward detachments, could not

move as often as field army HQ because it significantly disrupted operations. Thus the distribution problem only intensified as Fifth Army advanced up the peninsula and the units became separated at points. In December 1943, he lamented on the lack of transportation for interpreters at all echelons, and their inability to transport themselves, their equipment, or assist in delivering products to lower level units. He recommended the photo center needed at least four organic liaison aircraft to deliver prints and reports. Well into 1944, dissemination problems persisted. Responsiblities were not clearly idenitifed and the lack of organic transportation caused delays even when liaison aircraft became available. Interpreters sometimes bypassed air liaisons officers to expedite delivery to ground units. While many users preferred unannotated images, the increasing desire from others for annotations of grids, place names, objectives, etc. only increased the production timelines and further delayed delivery.[127]

Only later did the photo center maintain a robust dissemination capability to alleviate some of the previous problems. Jeep couriers made regular day and night runs to the army, corps and division headquarters with the latest reports and prints. Not until 1944 did adequate quantities of the L-4 and L-5s become available. They served directly with the divisions, corps, and armies as observers, artillery adjustment, and as couriers to and from the reconnaissance squadrons.[128] In many cases the corps and divisions diverted their liaison aircraft for artillery observation and adjustment to become couriers. The use of such aircraft allowed photos to reach "divisions before dark on the same day as taken," but unfortunately diverted them from other missions.[129]

To improve timeliness further, in July 1944 MAPRW increasingly sought a standardized distribution list for ground units; however, Fifth Army refused the request.

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Fifth Army's air liaison section determined that differences in unit types and terrain, and between defensive, offensive, and amphibious operations precluded any set quantity or type of dissemination. Even divisions of the same type could not agree. Fifth Army clearly desired enough copies to reach down the battalion, company and platoon levels.[130]

By far, tactical reconnaissance had the faster means of dissemination. Pilots reported significant information immediately to the army air-control center via radio. Aircaft controllers vectored alert fighter-bombers to the general area, then the F-6 pilots led them to the target. This tactic destroyed targets well in advance of ground forces since attack aircraft frequently reached targets within fifteen minutes. Upon landing, units disseminated pilot debriefing reports via radio and teleprinter to G-2s at all levels. The broadcasts provided the G-2 and G-3 important situational awareness on the results of long-range artillery fire, and major enemy movements.[131]

A post-war Rand study of Operation DIADEM concluded tactical reconnaissance did not reach "lower units" though this conclusion seems unclear. Admittedly the report indicates information from tactical reconnaissance missions may not have been recorded. According to the Fifth Army history, units down to at least the division level monitored the broadcasts.[132] Though other units below the division could have listened as well, it is unknown if they had the equipment and resources to do so. They likely focused on issues of greater importance. It is possible that lower units did not know about the broadcasts, yet given the well integrated liaisons at all levels and the praise tactical reconnaissance received from the highest echelons, it is doubtful that the units below the division did not know about the broadcasts. Whether they used them is a separate issue. Air liaisons at lower units may have monitored the broadcasts, though it is unknown if any did. At a

minimum, it seems most likely that the lowest units depended on upper echelons to pass

critical information from these missions.

Effect

While not war-winning, aerial reconnaissance had a significant impact on Fifth

Army operations in Italy. An Army Air Force observer concluded after discussions with

Fifth Army personnel that "70% of their intelligence comes from photographs."[133] While

impossible to confirm that assertion, a few examples do highlight the role it played.

Following the Anzio invasion, a German document from 12 February 1944 indicated,

"The enemy is now awaiting our major attack. He has detected our troop concentrations

partly by air reconnaissance. This and terrain conditions lead him to expect our main

blow from Aprilia and Cisterna."[134] German units recognized not only the important role

aerial reconnaissance played, as they employed reconnaissance flights themselves, but

more importantly what the allies had likely discovered as a result of these missions.

German units in Italy recognized aerial reconnaissance as a possible signal of allied

intentions. Captured documents from 2 February 1944 revealed the following:

> Army Group C declared that an invasion in the region of Civitavecchia was
> probable. An enemy air reconnaissance unit, which always has only been
> encountered where invasions occurred, has made its appearance there. The
> following countermeasures were taken: first, one battalion was made available for
> the Viterbo region; second, air reconnaissance was stepped up in the
> Civitavecchia region; third, our heavy air force units were alerted; and fourth, an
> anti-aircraft battalion of the Tenth Army was made available for the region of the
> Tiber bridges.[135]

Though the amphibious invasion never occurred at this location, about sixty miles

northwest of Anzio, it certainly represented the danger that reconnaissance missions

might eliminate the possiblity of operational level surprise, but also the degree of

deception possible as well. In early March, this and other activity likely led German leaders to place three divisions on alert status for "possible commitment in the Civitavecchia area . . . at once."[136]

A Rand study of the intelligence leading up to and during Operation DIADEM, 11-21 May 1944, provided important insights on the contribution of aerial reconnaissance. The Army Air Force flew 175 reconnaissance sorties between 1 April and 10 May 1944 for Fifth Army that provided locations on the following defenses prior to the operation's start:[137]

Table 3.	Aerial Reconnaissance Support to Operation DIADEM		
Position Type	Total Number of Positions	Number of Positions Located by Aerial Photos	Percentage Located by Aerial Photos
Artillery	82	72	88%
Anti- Aircraft	45	44	98%
Mortar	73	46	64%
Machine-gun	161	125	78%
Pillboxes	86	60	70%

Source: G.K. Tanham, *Battlefield Intelligence in World War II: A Case Study of the Fifth Army Front in Italy* (Santa Monica: Rand Corporation, 1956), iii, 37-39, 44.[138]

Aerial photos also provided Fifth Army the location of all sixteen German frontline units, and of two of the three close reserves.[139] Based on this, the Fifth Army knew the German Tenth Army had concentrated its defenses on the coastal plain and the Liri River valley, while leaving the nearby mountains lightly defended. Photos also confirmed, "Once the Gustav Line was broken, the attackers could probably push forward rather rapidly."[140] Aerial reconnaissance showed no reinforcements moving toward the front from northern Italy, nor had vehicle traffic near the front increased. Assured that the Germans knew

nothing of the impending attack, Fifth Army focused its main effort on the mountains with the French Expeditionary Corps. The study concluded that the six weeks of relative stability and calm afforded photo interpreters the time to conduct detailed analysis, and contributed significantly to the pre-attack intelligence picture.[141]

When the campaign started on 11 May 1944, the movement of forces gradually diminished the utility of photo reconnaissance, even though MAPRW flew 160 sorties in the first week and a near equal number in the following weeks. Even with a rate of advance of only two to three kilometers per day, the impact on photo reconnaissance was significant. Eleven days into the operations, "14 of 22 line battalions were identified, but only 4 were placed correctly . . . [and] of 16 reserve battalions, only 4 were identified and none was placed."[142] The order of battle became very confused with reinforcements frequently not located until ground units made contact with them, and aerial photos never located the six division headquarters during the fluid situation. By 19 May, the II Corps Artillery considered its artillery position list out of date and discarded it.[143]

Several reasons account for this including the movement of forces and the time lag in the intelligence cycle. Photo reconnaissance was best suited for detecting and locating fielded forces, but even with the slow advance it became much more problematic keeping track of moving units or knowing their location between when they were photographed and when they stopped or relocated. However, that does not explain the dearth of information on artillery positions or command posts located farther behind the front. With photo coverage up to ten to twenty miles deep, these should have been covered and usable with such a slow advance. Though most photo-based reports reached the Fifth Army well within twenty-four hours, the "G-2 considered the time lag too great

[during this situation] for the information to be valuable."[144] Germans units played a major role by relocating so frequently, they negated the results and complicated targeting. Ultimately, it truly demonstrated the problem of determining order of battle during a fluid situation, even with the ability of photo reconnaissance to "fix" the battlefield. Thus, the order of battle concept lost meaning once the attack began. Though the Rand study credited prisoner of war interrogations with providing most of the intelligence during maneuver operations, even a prisoner possessed obsolete information to a degree and interrogation delays only compounded the time lag. In most cases, prisoner information likely had little better timeliness than aerial photos. By 20 May, the Germans had retreated about twenty kilometers north and reform along the Hitler line.[145]

Once again, photo reconnaissance contributed to attacks on prepared defense, in this case the Gothic Line. As early as December 1943, aerial photos confirmed initial reporting of its construction. Although the Fifth Army did not reach the area until August 1944, reconnaissance aircraft regularly photographed the region throughout the spring. In June, Fifth Army received overprints at 1:50,000 scale of the entire area. The photo center then took over responsibility for coverage within its operations area, and regularly created overprinted maps and mosaics with updated defenses for planning. When Fifth Army finalized the attack plans, "photo interpretation, particularly of the Futa Pass area, was unusually detailed."[146] (see figure 45) Photo reconnaissance revealed not only the daunting defenses they faced, but also numerous delaying positions from the Arno River to the Northern Apennines.[147] Planners closely watched the construction of these positions with weekly coverage to locate strongpoints before camouflage made them more difficult to find. Though expelling the Germans did not get easier, ground units

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knew in large part what they faced and designed operations accordingly. For the Gothic

line alone, interpreters examined photos every week for a year that covered "every

possible scale and . . . every possible angle" before ground operations against the position

occurred.[148] However, even aerial photos had their limitations as experienced when units

reached the Gothic Line:

> If the enemy made good use of the mountains and his prepared defenses, which in
> fact proved to be much more extensive than preliminary air photos had indicated,
> only a coordinated attack against the heights on both sides of the road could
> achieve success.[149]

Clearly, photo reconnaissance was not a panacea.

With an understanding of the difficulties facing Fifth Army on the Arno River, it

tasked the 12th Photo Squadron for low-level obliques. Lieutenant Toomey flew an

important "dicing" mission to gain intelligence of the Arno River's north bank in

preparation for a crossing. This mission was particularly dangerous compared to

"dicing" a beach since it involved flying at low altitude the entire mission starting off the

coast to a point 180 miles behind German lines, then fifty miles inland to Florence, and

finally flying west down the river. Whereas pilots usually received missions the day

before or even the day of, Lieutenant Toomey had at least three days of mission planning

to prepare the details.[150] He successfully executed the sortie and later learned the pictures

"turned out great . . . exactly what 5th Army wanted."[151]
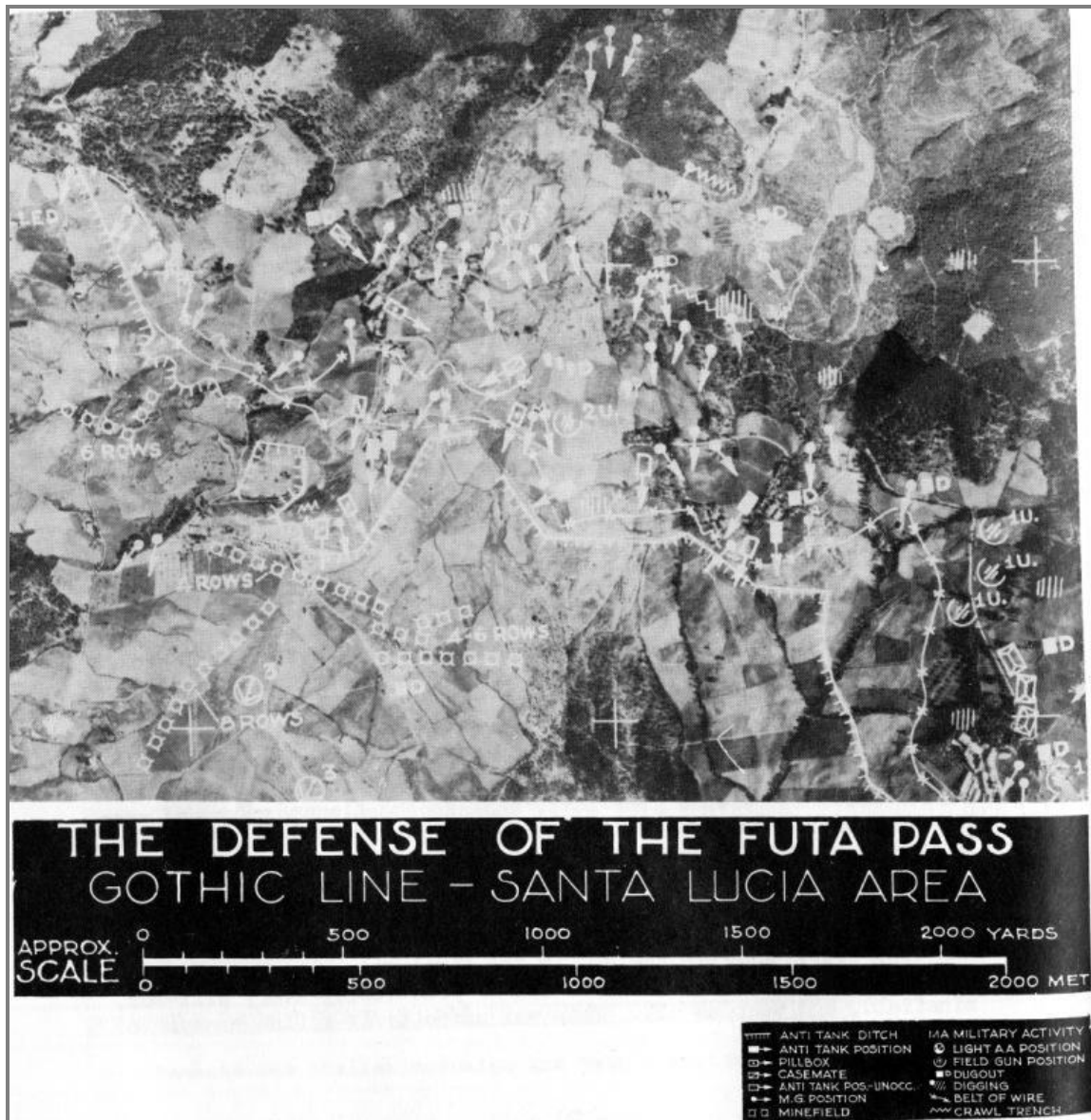
Figure 45. Aerial Photo of German Defenses at the Futa Pass (Gothic Line)
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 21.

The G-3 planning section that handled future operations constructed plans for

Fifth Army leadership to approve. According to the Fifth Army history, planners built

these future operations "only after careful studies of aerial photographs, records, maps,

and terrain models had been made."[152] (see figure 46) Below is typical of the analysis

that occurred using photographs to drive the scope and direction of future operations in the spring of 1945:

> Long study of photographs and maps of the Po [river] resulted in the decision that the best possible crossing sites in the projected Army zone of attack were along a 20-mile stretch of the stream extending from Ostiglia on Highway 12 west to Borgoforte, where the highway connecting Mantua and Reggio reached the banks. Within this section of the river 12 likely sites for assault crossings were determined, 12 ferry sites capable of floating 26 ferries were charted, and 9 possible sites for construction of floating bridges were selected. While these sites did not always coincide, in the majority of cases one site was favorable for all three types of operations. Equipment was available in Fifth Army to make a two-division assault crossing, each division employing two combat teams abreast. The western half of the 20-mile zone, between San Benedetto Po and Borgoforte, was favored over the eastern section as best for the initial crossing due to the proximity of the marshy rice fields in the area around Ostiglia. A subsequent crossing at the latter site was necessary, however, in order to open up the Highway 12 route to Verona.[153] [emphasis added]

Clearly aerial photos made a major contribution in determining not only the crossing sites, but also the size of the assault force and basic formation tactics.

Occasionally aerial photos were as important in planning for what they did as for what they prevented. The 82d Airborne Division originally had planned drops near Nocera and Sarno, about ten miles northwest of Salerno. During the planning phase, "excellent aerial photographs were obtained" that showed the area in detail. While examining the transport aircraft approaches, one faced significant anti-aircraft fire while another required flight over the mountains on the Sorrentine peninsula. Additionally, the drop zones appeared unsuitable and the glider landing fields would have left the forces widely separated. These factors caused planners to reject drops at these locations.[154]

CASSINO AND MONTE CASSINO. COVERS APPROXIMATELY 192 SQUARE MILES. USED FOR TACTICAL PLANNING.

WESTERN PORTION OF GOTHIC LINE. COVERS APPROXIMATELY 5400 SQUARE MILES. THIS TYPE USED FOR STRATEGIC PLANNING.

Figure 46. Terrain Models of Northern Italy
Source: 3rd Photo Group, *Photo Recon for MATAF and 15th Army Group*, (1945), 52.

Frequently aerial photos provided little more than minor clues of German activity. In early November 1943, tactical reconnaissance flights discovered large German forces

moving south to reinforce its defensive positions for winter. These units were later confirmed to be the 305th Grenadier (Infantry) and the 94th Grenadier Divisions. Within the Anzio beachhead, "aerial photography flights continued to improve our knowledge of German positions and compensated in large part for our lack of good terrestrial observation."[155] Photo interpreters discovered a German counter-attack at Anzio simply by analyzing artillery positioning. During November 1944, as Fifth Army approached Bologna, reports from ground patrols indicated German forces were quickly constructing defenses. Aerial photos confirmed these reports and "showed a constantly expanding belt of prepared positions in depth between the front and Bologna."[156] A month later, Italian partisans and German prisoners reported repairs were underway on bridges and roads in the upper Serchio River valley. Once again, aerial photos verified these reports and helped Fifth Army prepare for a German offensive on 26 December.[157]

Photo reconnaissance made a major contribution toward interdicting German reinforcements and supplies moving south. As early as September 1943, NAPRW provided large-scale coverage of the Po River valley in northern Italy, and 2,400 miles of other rivers and lines of communication. Frequent coverage of roads, railways, and associated nodes such as marshalling yards, bridges, and crossroads allowed the strategic and tactical air forces to target these areas to interdict the flow of Axis ground forces, supplies, and reinforcements. During Operation Avalanche, B-17s targeted both road bridges and the railroad bridge over the Volturno River at Capua, about thirty miles north of the invasion beaches. Aerial photos later revealed the strikes destroyed the road bridges and severely damaged the railway crossing to help isolate the bridgehead area from German reinforcements. In fact, some considered this raid a "replacement" for the

cancelled airborne drop.[158] Similarly, throughout 1944 photo reconnaissance played a major role in Operation Strangle, a concerted effort to cut German lines of communication. Though the campaign never "totally cut off lines of communication, the disruption caused by forcing the enemy to use improvised methods . . . appeared to put him in the position of being unable to respond adequately to increased pressures on the ground."[159] Arguably, German forces could do little more than launch localized counterattacks after mid to late 1944, not conduct major offensives.

Based on the successes in locating and attacking German units, equipment, and defenses, intelligence elements throughout Fifth Army increasingly emphasized targeting as a major function. Fifth Army found target development so lucrative it established a G-2 section to locate targets from photographs for artillery and air attacks. The target section often received tips from other sources on where to look. Target areas included not only the frontlines, but also rear areas. Interpreters produced annotated photos as part of target nominations to the XXII TAC, from which pilots used these as part of planning and execution.[160] The target selection process "reached an almost exact science."[161]

Similar efforts occurred at the corps level as well. The IV Corps G-2 plotted multi-source intelligence on maps to understand the array of forces. As information coalesced, he passed targets to interpreters for analysis. The Chief of Staff, G-3, G-2, Artillery, and Air representatives reviewed satisfactory targets within the corps' area of operations to determine suitability and feasibility for targeting. If outside the operations area, the corps passed target information and photos to the TAC for attack. Subsequent coordination occurred to integrate communication and timing with ground operations. II Corps had a comparable process to employ aerial photos. At all levels, targeting in this

manner worked best in static situations when the time between detection and coordination allowed pre-arranged strikes. In fluid situations, the ability to locate and fix targets before they moved became much harder.[162] As such, delays in getting information to the target sections and the enemy's ability to move somewhat negated the tactical impacts

Tactical reconnaissance missions helped solve this by giving aircraft specific and general areas to search for enemy activity. Given the limited photo reconnaissance capacity of the tactical reconnaissance squadron, its primary focus remained visually locating enemy forces and movements, and adjusting long-range artillery fire. This became particularly important during the mobile situations when the impact of photo reconnaissance became degraded as discussed in Operation Diadem. In that operation, tactical reconnaissance helped fill the void by tracking road movements to "reveal lines of retreat or movement of reserves."[163] In other operations, it kept artillery positions in the Liri Valley and around Atina under surveillance from near continuous missions.[164] Search areas usually stemmed from various intelligence sources and terrain analysis of areas the Germans would likely occupy. Below is a typical example of the effect of tactical reconnaissance missions:

> Air observation planes on 9 September [1944] flew at low altitude up Highway 65 and along the north side of the Sieve Valley from San Piero to Borgo San Lorenzo without spotting military activity or drawing antiaircraft fire. All the evidence pointed to the fact that the enemy had withdrawn the bulk of his troops to his Gothic Line positions, thereby placing them well beyond the range of both division and Corps artillery and necessitating the movement of all attack elements to new forward assembly areas.[165]

Along with visually aquiring targets, tactical reconnaissance pilots directed large amounts of long-range artillery. General Heinrich von Vietinghoff, the German Tenth Army Commander, provided the following in a post-war interrogation:

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The artillery-spotting pilots were unpleasant as well. Their mere presence enforced silence upon our artillery. Each soldier felt himself observed and recognized by the artillery-spotting pilot, even when this was not the case. In this manner, in decisive phases of the battle, the center of gravity of our defenses, the artillery, fell away.[166]

During a mid-March 1944 attack, tactical reconnaissance directed the efforts of 746 guns and howitzers in a massive air-ground bombardment of the Cassino area. It remains unclear how even the entire squadron would have adjusted fire from that many batteries. Combined with ground (Rover Joe) and air (Horsefly) based controllers, these aircraft became effective against fleeting targets by directing artillery and aircraft against them.[167]

Conclusion

Visual and photo reconnaissance operations in support of ground commanders truly matured in Italy after two and a half years of experience in the Mediterranean theater. Recconnaissance units made an impressive effort in support of Fifth Army's advance up the Italian peninsula. Reconnaissance units flew thousands of sorties to bring back vital intelligence on German order of battle, disposition, movements, and defenses. Reconnaissance units, the Fifth Army, and liaisons officers perfected effective tasking, collection and interpretation tactics and techniques, albeit somewhat distinct from doctrine of the period, that kept assets responsive to needs of ground commanders. That they still struggled in many respects with dissemination was not due to a lack of effort.

The 3d Group history claimed that Fifth Army loosely earned the distinction as "the most 'Photo Conscious' Army in the world."[168]

During the course of the Italian campaigns, the use of air photos in the field developed to an extent which revolutionized many branches of intelligence practice. The demand for the products of aerial photography, the development of fresh techniques in their utilization, constantly introduced new possibilities in both planning and operational fields. The implication of these new possibilities

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were always in process of being worked out in the field, and nothing approaching a standardization of practice was ever achieved.[169]

A look at the volume of production is staggering and seems to support that contention. With the German Air Force collapse by early 1944, "air intelligence focused almost entirely on interdiction and close air support," both of which supported Fifth Army objectives.[170] By 15 March 1944, MAPRC allocated 33 percent of its sorties to Fifth Army, and another 11 percent to the British Eighth Army. Just two months later, of the 1.66 million prints MAPRW distributed in May 1944 alone, 68 percent supported Army units while 29 percent went to aviation units.[171] In recognition of these continued efforts, the 3d Group received a Distinguished Unit Citation for actions on 28 Aug 1944 deemed critical to Fifth Army's operations against the Gothic Line. On that day, the group frequently responded to short-notice calls that required twenty-four hour operations such that "results from these efforts proved to be of inestimable value and contributed in a great degree to the rapid advance of our ground forces against a determined enemy."[172]

However, aerial reconnaissance still faced challenges posed by terrain, enemy camouflage, and resources. Mobile operations exposed the flaws within the production timeline between when photos were taken and when reports and prints reached ground units for decision-makers to act. No amount of coordination could compensate for the dissemination problems encountered. Reconnaissance squadrons produced thousands of voice and written reports summarizing activity observed, and supported this analysis with millions of prints. Pre-war advocates of reconnaissance must have marveled that prints reached down to individual Army platoons. While many of these products reached units in time, enough of them did not for ground units to make regular references to the shortfall.

[1]Western Naval Task Force, *The Italian Campaign-Western Naval Task Force: Action Report of the Salerno Landings September - October 1943* (1943), 1-2, 4-5.

[2]In this method, after Salerno the Volturno River served as the holding line and the Gustav line became the main defense. Following the Cassino breakthrough, the Adolph Hitler line was the holding line while the Palestrina line served as the main defensive position. With the Anzio breakout, German forces quickly withdrew from there for the Arno River as the holding position and the Gothic line as the main position. Finally, the Germans prepared to hold at the Po River and conduct the main defense along a line from Venice to Lake Garda.

[3]Martin Blumenson, *Salerno to Cassino* (Washington, DC: Office of the Chief of Military History, U.S. Army, 1969), 182-183, 207-208; Ernest F. Fisher, Jr., *Cassino to the Alps* (Washington, DC: Center for Military History, U.S. Army, 1977), 90-93, 181, 202, 267-269, 291-292, 308-310, 337, 448.

[4]The Fifth Army Photo Center is sometimes referred to as the Fifth Army Photo Intelligence Center.

[5]XXII Tactical Air Command replaced XII TAC when the latter transferred in July 1944 to support the invasion of southern France.

[6]Fifth Army, *Fifth Army History Part II: Across the Volturno to the Winter Line* (1944), 98; Boyle, 661; 3rd Photo Group,17.

[7]3rd Photo Group, 17.

[8]Ibid., 19.

[9]Frank Crate and Wesley Craven, *The Army Air Forces in World War II, vol. 3 of Europe: Argument to V-E Day January 1944 to May 1945* (Chicago: University of Chicago Press, 1949), 329.

[10]Headquarters, Mediterranean Allied Air Force, *The History of M.A.A.F 1 September 1944 - 9 May 1945* (1945), 269.

[11]XXII TAC evolved from the XII Fighter Command that itself was created from the Army Air Force units associated with the Mediterranean Allied Coastal Air Force. Crate and Craven, vol. 3, 442, 450.

[12]Major James Quello, "Tactical Reconnaissance in the Fifth Army," *Military Review* 24 (December 1944): 18.

[13]Boyle, 530; Western Naval Task Force, *The Italian Campaign*, 176-177.

[14]Fifth Army, *Fifth Army History Part I: From Activation to the Fall of Naples* (1944), 26-27.

[15]Western Naval Task Force, *The Italian Campaign*, 177.

[16]Ibid., 178-179.

[17]Fifth Army, *Fifth Army History Part I*, 26-27; Western Naval Task Force, *The Italian Campaign*, 178-180.

[18]Western Naval Task Force, *OPERATION PLAN NO. 7-43*, Annex A, Enemy Strength, 2.

[19]Western Naval Task Force, *OPERATION PLAN NO. 7-43 - SHORT TITLE "AVON/W1,"* (1943), Annex A, Supplement No. 1, 1 and Annex B, Gunfire Support Plan; Western Naval Task Force, *The Italian Campaign*, 184; 3rd Photo Group, 39.

[20]Boyle, 343, 356, 661.

[21]Ibid., 661-662, 665-666.

[22]Ibid., 136-137, 141-142.

[23]Ibid., 145-146.

[24]Headquarters, Mediterranean Allied Photo Reconnaissance Command, *Memo from Major Phillip Kennedy to Colonel John Warren* (1944), 2.

[25]Boyle, 137-139; Northwest African Photographic Reconnaissance Wing, *N.A.P.R.W. Interpretation Report - Q.1, November 1943* (1943), cover letter, 1-2.

[26]Boyle, 663-664; Fifth Army, *Fifth Army History Part I*, 53.

[27]Pilots generally received fifteen to twenty pinpoint targets per mission, with less targets if mapping coverage was levied. Boyle, 143, 662.

[28]Ibid., 144-145.

[29]Fifth Army, *Fifth Army History Part I*, 27.

[30]Major Boyle even referred to this spirit of cooperation as a policy; though it is not clear whether this was written or unwritten.

[31]Boyle, 124-125, 143, 145, 432.

[32]Army Air Force Historical Office, *Air Phase of the Italian Campaign to 1 January 1944* (Army Air Force Historical Office: 1946), 69, 175, 376; Crate and Craven, vol. 2, 499, 528; Matthew G. St. Clair, "The Twelfth US Air Force: Tactical and

Operational Innovations in the Mediterranean Theater of Operations, 1943-1944"
(master's Thesis, Air University Press, 2007), 42; Western Naval Task Force, *The Italian Campaign*, 199.

[33]Western Naval Task Force, *The Italian Campaign*, 202; Crate and Craven, vol. 2, 499, 528.

[34]Western Naval Task Force, *The Italian Campaign*, 202.

[35]By late 1943 and early 1944, some sources inexplicably begin using the term Mediterranean Allied Photo Reconnaissance Command (MAPRC). No references located in the research of this thesis indicated when or why this occurred. The term MAPRW continued to be used as well. For historical accuracy, the author stayed with the terms used in the sources researched, but the two appear to be the same organization.

[36]Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program of M.A.P.R.C. with Fifth Army Operation 'SHINGLE'* (1944), 1-2; Fifth Army Photo Reconnaissance Unit, Captain F. W. Elworthy, *Report on Aerial Photography with Fifth Army in Operation 'SHINGLE'* (1944), 1-3; Headquarters, Mediterranean Allied Photo Reconnaissance Command, *Memo*, 1.

[37]Fifth Army, *Fifth Army History Part IV: Cassino and Anzio* (1944), 12-13.

[38]Fifth Army Photo Reconnaissance Unit, *Report on Aerial*, 2; Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program*, 2-3.

[39]Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program*, 4; 3rd Photo Group, 40.

[40]Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program*, 4; Fifth Army Photo Reconnaissance Unit, Capt. F. W. Elworthy, *Report on Aerial*, 2; Fifth Army, *Fifth Army History Part IV*, 109-110, 125-126.

[41]St. Clair, 57.

[42]Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program of M.A.P.R.C. with Fifth Army Operation 'SHINGLE'* (1944), 5-6.

[43]Headquarters, Mediterranean Allied Photo Reconnaissance Command, *Memo*, 1-2.

[44]Mediterranean Allied Air Force, Chapter VIII, 1 and Appendix A; Capt. William Montgomery, *Report on Tour of Duty in the Mediterranean Theater of Operations* (1944), 4; Captain William Montgomery, *Report on Tour of Duty in the Mediterranean Theater of Operations* (1944), 4.

[45]Mediterranean Allied Air Force, Chapter VIII, 2.

[46]Ibid.

[47]Ibid.

[48]Ibid., Chapter VIII, 3.

[49]While not a direct part of this thesis, an interesting comparison would be the length of field army fronts in France and Germany compared to Fifth Army. Fifth Army fronts seem to average about sixty miles. Depending on the field army and period selected, those in France and Germany averaged about sixty to eighty miles at some points, while in others exceed 100 or even 200 miles. Longer fronts required selective coverage at a shallower depth, and therefore increased the likelihood of overrunning the coverage. Therefore, if Fifth Army less frequently overran its coverage, this might help explain the generally more positive feeling on photo reconnaissance between it and field armies in France and Germany. Ibid., Chapter VIII, 3-4.

[50]Montgomery, 4.

[51]Colonel H. J. P. Harding, *Subjects of Interest to G-2*, AGF (1944), 2; 3rd Photo Group, 17; Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program*, 4-5.

[52]Fifth Army Photo Reconnaissance Unit, Capt. F. W. Elworthy, *Basic Cover* (1944), 1-3.

[53]3rd Photo Group, 3-4, 10-11.

[54]Ibid., 2-4.

[55]Ibid., 17.

[56]Captain Stopp, *Field Intelligence Notes* (1944), 9.

[57]Montgomery, 4; Fifth Army, *Fifth Army History Part VIII: The Second Winter* (1945), 62; 3rd Photo Group, 18.

[58]3rd Photo Group, 19, 32.

[59]3rd Photo Group, *Photo Recon for MATAF and 15th Army Group* (1945), 32.

[60]3rd Photo Group, 19; Blumenson, 420.

[61]3rd Photo Group, 19.

[62]Fifth Army, *Fifth Army History Part VIII*, 60; Quello, 18; 15th Army Group, *A Military Encyclopedia Based on Operations in the Italian Campaigns, 1943-1945* (15th Army Group, 1945), 69-70.

[63]Quello, 18-19.

[64]Ibid.

[65]Fifth Army, *Fifth Army History Part VIII*, 60.

[66]15th Army Group, 71-72.

[67]Army Air Force Historical Office, *Air Phase*, 163-164.

[68]3rd Photo Group, 22.

[69]Boyle, 566-567; Fifth Army, *Fifth Army History Part III: The Winter Line* (1944), 19; Fifth Army, *Fifth Army History Part VII: The Gothic Line* (1945), 109, 130.

[70]Fifth Army, *Fifth Army History Part VII*, 179.

[71]D.F. Toomey, Tall Tales and Vapor Trails: Recollections of a WWII Photo-Recon Pilot (2001), 135.

[72]Boyle, 665; 3rd Photo Group, 7-8.

[73]Toomey, 171.

[74]3rd Photo Group, 7-8; Fifth Army, *Fifth Army History Part VIII*, 61-62.

[75]3rd Photo Group, 23, 56.

[76]Army Air Force Historical Office, *Air Phase*, 69.

[77]Toomey, 134.

[78]Lieutenant Toomey stated flak usually approached pilots from behind. Using rear-view mirrors, they looked for flak explosions behind their aircraft then executed this tactic.

[79]Ibid., 127, 135, 159; Montgomery, 6.

[80]Montgomery, 5-6.

[81]Toomey, 133.

[82]Ibid., 132-133, 142.

[83]Ibid., 133-134.

[84]3rd Photo Group, 5, 10; Toomey, 134, 158, 177, 244, 257.

[85]3rd Photo Group, 23.

[86]Ibid., 10, 23; Toomey, 117, 202.

[87]Headquarters, Mediterranean Allied Air Force, *Air Power in the Mediterranean: November 1942 - February 1945* (1945), 78.

[88]Ibid.

[89]Montgomery, 3; 3rd Photo Group, 90; Boyle, 612.

[90]Toomey, 255.

[91]Lieutenant Toomey contends that once Captain Lazzeroni left the squadron, the 12th Photo Squadron ended the program for lack of volunteers. Toomey, 256.

[92]3rd Photo Group, 90.

[93]15th Army Group, 63.

[94]Boyle, 530, 664; Crate and Craven, vol. 2, 537.

[95]Lieutenant Colonel F. R. Fuglesang, *Report on the Use of Aerial Photography During Mobile Operations* (1944), 1-2; Toomey, 202.

[96]Fuglesang, 2-3; 3rd Photo Group, 34-35.

[97]3rd Photo Group, 35-36.

[98]Fifth Army Photo Reconnaissance Unit, Major F. W. Elworthy, *Photo Requirements of Ground Troops in Operations* (1944), 4.

[99]Toomey, 147-148.

[100]3rd Photo Group, 10, 34; Toomey, 206, 235-236, 259.

[101]Army Air Force Historical Office, *Air Phase*, 150.

[102]Fifth Army Photo Reconnaissance Unit, *Photo Requirements*, 4-5.

[103]Fifth Army, *Fifth Army History Part VIII*, 61.

[104]Quello, 20; 15th Army Group, 72.

[105]3rd Photo Group, 39-40, 43; 15th Army Group, 53.

[106]3rd Photo Group, 12, 28.

[107]Ibid., 18, 28-29.

[108].

[109]Major Harold Miller, *Memo: G-2 Report on Italian Campaign* (1944), 2; 15th Army Group, 57-58, 64; Harding, 2-3; 3rd Photo Group, 28.

[110]Miller, 3.

[111]Fifth Army, *Fifth Army History Part VII*, 9.

[112]Boyle, 665.

[113]Ibid., 666.

[114]Ibid., 666-667.

[115]Headquarters, Mediterranean Allied Air Force, *Air Power*, 77.

[116]Ibid., 77.

[117]Boyle, 667.

[118]Chris Staerck, ed., *Allied Photo Reconnaissance in World War II* (San Diego: Thunder Bay Press, 1998), 72.

[119]Montgomery, 3.

[120]Harding, 7; 15th Army Group, 60; Fifth Army Photo Reconnaissance Unit, *Photo Requirements*, 5-6.

[121]Northwest African Photographic Reconnaissance Wing, 3-60.

[122]Stopp, 9.

[123]3rd Photo Group, 56.

[124]Ibid., 56-57.

[125]Fifth Army Photo Reconnaissance Unit, *Photo Requirements*, 4; 3rd Photo Group, 12.

[126]Boyle, 665.

[127]Ibid., 665; Headquarters, Mediterranean Allied Photo Reconnaissance Command, *Memo*, 2; Stopp, 10.

[128]3rd Photo Group, 31; Infield, 66.

[129]Boyle, 665.

[130]Fifth Army Photo Reconnaissance Unit, *Photo Requirements*, 1-3.

[131]St. Clair, 57; Quello, 19-20; Fifth Army, *Fifth Army History Part VIII*, 61.

[132]G.K. Tanham, Battlefield Intelligence in World War II: A Case Study of the Fifth Army Front in Italy (Santa Monica: Rand Corporation, 1956), 70; Fifth Army, *Fifth Army History Part VIII*, 61.

[133]Montgomery, 3.

[134]Government Military Documents Section, *The German Operation at Anzio: A Study of the German Operations at Anzio Beachhead From 22 Jan 44 to 31 May 44* (1946), 47.

[135]Ibid., 26.

[136]Ibid., 81.

[137]This study focused on the period from 11-21 May 1944 during Operation DIADEM. Though the report admittedly had gaps in information, it offers a comprehensive analysis of the intelligence available to the Fifth Army and its subordinate units as well as German forces.

[138]Other sources such as prisoner of war interrogations accounted for the difference in positions located. Some of these positions may have been tipped by other intelligence sources and photo reconnaissance merely confirmed the presence or location. It is impossible to say how frequently this occurred.

[139]While front-line units were well known, the location of rear area units was very limited before the attack. Photo intelligence also did not provide much information on the relative strength or morale of units beyond basic equipment counts.

[140]Tanham, 29.

[141]Ibid., iv, 9, 17, 22, 25, 27, 32, 34, 48-49.

[142]Ibid., 56.

[143]Crate and Craven, vol. 3, 384, 390; Tanham, iii-v, 53, 63.

[144]Tanham, 74.

[145]G.K. Tanham, Battlefield Intelligence in World War II: A Case Study of the Fifth Army Front in Italy (Santa Monica: Rand Corporation, 1956), 64, 74, 77, 79

[146]Fifth Army, *Fifth Army History Part VII*, 10.

[147] Ibid., 17.

[148] 3rd Photo Group, 20.

[149] Fifth Army, *Fifth Army History Part VII*, 56.

[150] Toomey, 207-208.

[151] Ibid., 210.

[152] Fifth Army, *Fifth Army History Part VIII*, 56

[153] Fifth Army, *Fifth Army History Part IX: Race to the Alps* (1945), 31.

[154] 82d Airborne Division, 42.

[155] Fifth Army, *Fifth Army History Part V: The Drive to Rome* (1944), 102.

[156] Fifth Army, *Fifth Army History Part VIII*, 8.

[157] Fifth Army, *Fifth Army History Part III*, 7; 3rd Photo Group, 19; Fifth Army, *Fifth Army History Part VIII*, 16-17.

[158] Boyle, 125; Army Air Force Historical Office, *Air Phase*, 117.

[159] Kreis, 181-184.

[160] Montgomery, 1; Fifth Army, *Fifth Army History Part VIII*, 63, 169.

[161] Fifth Army, *Fifth Army History Part VIII*, 167-168.

[162] Major Francis Keil, Assistant Adjutant General, IV Corps, *Battle Experiences, Coordination of Various Arms* (1945), 1; Brigadier General John Willems, Chief of Staff, II Corps, *Battle Experiences, Coordination of Various Arms* (1945), 14-17.

[163] Tanham, 76.

[164] Montgomery, 8; Crate and Craven, vol. 3, 388.

[165] Fifth Army, *Fifth Army History Part VII*, 43.

[166] Headquarters, Mediterranean Allied Air Force, Intelligence Section, *Air Surrender Documents* (Headquarters, Mediterranean Allied Air Force: 1945), 102.

[167] Fifth Army, *Fifth Army History Part IV*, 178; Willems, 19; Crate and Craven, vol. 3, 388.

[168] 3rd Photo Group, 31.

[169] 15th Army Group, 49.

[170] Kreis, 177-178, 190.

[171] Mediterranean Allied Photographic Reconnaissance Command, *Photographic Program*, cover letter; Montgomery, 5.

[172] This is an extract of a copy of the DUC as taken from Infield's book. Infield, 79.

CHAPTER 6

CONCLUSION

Army Air Force photo and tactical reconnaissance reached its pinnacle in 1945 and seemed to live up to German General Werner Von Fritsch's comment that "the best aerial photoreconnaissance will win the next war."[1] However, that success did not come without difficulty. The 3d Group's history concluded "photo reconnaissance was a much misunderstood weapon at the beginning of the war."[2] Army units did not understand the capabilities and limitations of this intelligence source, nor did the 3d Group understand what the Army needed.[3] Even in 1945, ground units did not fully appreciate the applications of this capability, nor could it fulfill all of their needs.

Photo and tactical reconnaissance pilots flew thousands of missions, while interpreters issued thousands of reports and millions of photo prints, yet numbers alone do not tell the whole story. Whether examining aerial reconnaissance organization, doctrine, training, equipment, or people, it clearly exceeded the pre-war status and abilities. From its early applications in North Africa, through Sicily and concluding in Italy, aerial reconnaissance evolved as organizations and individuals learned and adapted to the demands of combat operations. Pre-1942 doctrine largely covered the breadth of topics, but only experience learned through trial and error provided the detail that existed by war's end. Similarly, F-5s in 1945 could fly 600 miles, cover dozens of targets, and return home with pictures of enemy activity. In all areas, these and other developments far surpassed the early war capabilities, yet these successes obscure a true examination of how effectively did aerial reconnaissance support ground commanders?

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In 1945, senior commanders, most notably Fifth Army's General Clark, praised the effect of aerial reconnaissance on ground operations. He commended the 3d Group in March with the following, "During our operations in Italy we have found aerial photography to be one of the most accurate, rapid, and comprehensive means at our disposal for obtaining information on the enemy . . . My Staff has often commented upon the effectiveness of your unit."[4] In many respects, it deserved this acclaim. After overcoming the teething problems in North Africa, photo reconnaissance made major contributions in the amphibious invasion planning for Sicily and Italy. German defenders, optimized for terrain defense, had a difficult time hiding positions at or near the invasion beaches. This intelligence along with terrain analysis helped determine the optimal beaches to assault and inland areas for subsequent operations. Aerial photos also played a role in various parts of North Africa, Sicily, and Italy when German forces decided to defend along defensive strongholds. With frequent revisits, photo reconnaissance offered a unique capability to compare the most recent photos with previous coverage for change analysis. This highlighted the arrival or disappearance of units, impacts of enemy activity on the terrain, and defensive preparations. Only rugged terrain and camouflage offered German units any protection in those situations.

Tactical reconnaissance made most of its contribution in Sicily and Italy, but its true effect is somewhat less conclusive due to limited references within the available source material. It largely played a role in artillery adjustment and scouting areas for enemy supplies, reinforcements, and unit movements. These missions played an integral role in directing tactical air force fighter-bombers against such targets, in supplementing

F-5s when weather precluded high-altitude missions, and in overcoming the inherent weakness that photographs represented a moment in time.

That aerial reconnaissance enjoyed these successes resulted from several factors: changes in organizational and control relationships, the extensive use of liaisons, improvements in tactics and techniques, and at least in Italy, the terrain itself. The air power difficulties in North Africa forced a critical review of its organization and employment. As a result, ground commanders lost most of their organic Army Air Force units as they reorganized under tactical, strategic, and reconnaissance commands. While this centralization increased efficiency, it reduced the ability of reconnaissance units to support ground commanders effectively. As additional personnel and aircraft became available, the 3d Group implemented a program of photo reconnaissance detachments to work for ground commanders. Success with these detachments led to their expansion into full squadrons. Employment of tactical reconnaissance units similarly evolved when the Tactical Air Command eventually allocated missions to Fifth Army for tactical control and execution. The TAC still retained operational control and "approved" the missions, but effectively the Fifth Army employed these aircraft as needed.

These changes marked a key development since the Army Air Force sacrificed a measure of control, but also opened a unique opportunity. Since photo reconnaissance fell under MAPRW and tactical reconnaissance under the XII Air Support Command and later the TACs, true operational control over both rested with the Mediterranean Allied Air Force. Coordination and deconfliction in support of ground commander requirements may have occurred, but it is unknown to what extent. The Fifth Army G-2 section had tactical control of both the 12th Photo Squadron and any allocated tactical reconnaissance

aircraft by 1945. This authority permitted a single organization closest to the problem, yet with a broad perspective, to direct the daily taskings of each reconnaissance type without additional bureaucratic channels, and allowed the quick transition between each as the operational situation alternated between maneuver and defense.

Coupled with these organizational relationships was an emphasis on ground and air liaison officers to improve coordination. Air liaisons existed at all echelons from army to division, and the Army sent similar liaison officers to the reconnaissance units. These individuals helped coordinate and clarify requirements, and most importantly served to educate their opposite numbers. "The Group had to teach the divisional commanders and their staff what Photo Recon could and could not do. The Army also had to teach us what it wanted and what it did not want."[5] Ground liaison officers kept reconnaissance units abreast of the ground situation and even briefed and debriefed pilots. Collectively, the liaisons helped bridge the geographical separation that occurred between the reconnaissance units and the ground force headquarters. Liaisons depended heavily on phones, radios, and teleprinters to overcome these obstacles and maintain contact with their parent organizations.

Next, reconnaissance units perfected the tactics and techniques necessary to execute such missions repeatedly against an ever-changing enemy. Though understood at a basic level, the pre-war field manuals never covered the complex relationships between camera focal length, the aircraft, operating altitude, terrain and the threat to the degree needed or understood by 1945. These only developed over time as units met intelligence requests while facing combat operations. This required the determined persistence of everyone involved to find solutions to the myriad of challenges they encountered. As an

indication of the desire for continual improvement, Lieutenant Colonel Wilfrid Worland, the 941st Engineer Aviation Topographic Battalion commander, commented in 1944, "photo intelligence has outgrown all pre-war conceptions of its role and its capabilities must be re-evaluated."[6] Whether using seawater to develop film prints in the absence of fresh water, or selecting the right film speed based on seasonal variations, the technical complexity of aerial reconnaissance is a major factor that should not be overlooked. After the Salerno invasion, the 3d Group's tactics and techniques truly coalesced and "efficiency and speed were attained."[7]

Ironically, the same terrain that made photo interpretation more difficult, also limited operational maneuver and permitted German units to delay the allied advance. Terrain played a major factor in reducing mobility and made the situation more conducive to photo reconnaissance operations. This likely contributed to the overall positive assessments from U.S. Army units in this theater compared to those in the European theater as described below.

Despite these positives, aerial reconnaissance had its shortcomings, many of which the units repeatedly seemed to relearn after each operation or campaign. Foremost, weather played one of the biggest operational limitations for photo reconnaissance. A single cloud might obscure an entire target area from 30,000 feet, while an overcast sky frequently grounded missions. While good at determining capabilities, location and order of battle, it generally could not ascertain enemy intent or morale. Resource shortages presented a continual challenge. From November 1942 to May 1945, the 3d Group rarely achieved full strength of sixteen F-5s and twenty-six pilots within its three flying squadrons.[8]

Photo reconnaissance played a pivotal role against fixed defenses, but fell short during mobile operations. The collection cycle from requirement identification, tasking, collection, film development, interpretation and dissemination often could not keep pace, even with a slow advance pace as described during Operation Diadem. In Italy, units partly overcame this challenge by maintaining a close physical relationship with the Fifth Army HQ by using collocated forward detachments. The close proximity often allowed unit personnel to meet each other directly, rather than depending exclusively on liaisons. When coupled with the tactical control relationship, these helped, but enemy movements could easily negate what a photo displayed. Moreover, the photo center still had to disseminate photos to the corps and the corps to the division, each of which could have tens of miles of separation and a limited ability to reach units. Where pictures fell short, tactical reconnaissance pilots used visual observations to monitor enemy activity and quickly disseminate it via radio to the division command post. Unfortunately, the limited number of aircraft and the limited detail they provided made it impossible to "fix" the battlefield like a photo. Due to these factors and the chaos of movements on both sides of the frontlines, ground commanders quickly lost sense of the order of battle relative to what photo intelligence provided.

By 1943, ground commanders seemed to have sufficient coverage of the right areas; the issue became the timeliness. Each day, reconnaissance missions brought back coverage of hundreds of square miles of enemy territory, yet for a variety of reasons it was not always developed, interpreted, and delivered to ground forces in a timely fashion. While production played a limited role, the delays really reflected the rather rudimentary means of delivering reports and photo prints from the airfield to the geographically

separated headquarters. Telephones and radios alone could not handle the large quantities of information that reconnaissance units had to pass. Teleprinters offered a means of mass dissemination, but personnel still had to prepare and type the messages. Moreover, these means did not address the dissemination of the photo prints. The photo center and the corps frequently lacked sufficient jeeps or liaison aircraft dedicated to nothing more photo dissemination. Therefore, even the best efforts by reconnaissance units were sometimes diminished by an inability to get the intelligence to those organizations that needed it. This communication deficiency plagued intelligence dissemination except during future operations planning when a sufficient time buffer accommodated the tardiness.

In the final analysis, aviation and ground officers not surprisingly offered different perspectives on aerial reconnaissance. The Army Air Force had a decidedly more positive view of this subject. Contemporary reports and writings seemed to imply that because squadrons took the photos, ground commanders must have used them and therefore they were effective. This somewhat explains the emphasis on sorties flown, number of prints made, and square mileage covered. This quantitative approach ignored measures that would have better evaluated the effectiveness. Aerial reconnaissance no doubt contributed in some of the situations already described, but as equally discussed, that success was not universal. In fairness to aviators, reconnaissance operations involved a complex process to integrate the capabilities needed to acquire even a single photo. That they did so repeatedly without significant losses was itself a measure of success. If ground units criticized the timeliness of photos, they may not have understood or appreciated the intricacy of this process.

From the Army's perspective, its level of satisfaction varied depending on the echelon considered. Armies and corps tended to view aerial reconnaissance more positively, at least by the Italian campaign. This stemmed from their broader perspective and the fact that generalized locations of enemy units or defensive lines from photos or observers served the basic purpose of identifying enemy force composition and disposition. This positive outlook also reflected the ability of those organizations to more directly "control" or influence reconnaissance taskings, and therefore get results. As an example, Fifth Army and the corps were very satisfied with the support provided to the counter-battery artillery effort. On the other hand, divisions needed much more finite intelligence on the size and location of enemy units, and generally within tighter timelines because of enemy movements. Consequently, beyond planning an amphibious invasion or operations against fortified positions, divisions tended to view the effect of aerial reconnaissance more mixed.

By contrast, reconnaissance units in the European theater had less impressive results, especially at lower echelons where it mattered most. Divisions generally thought the armies and corps monopolized reconnaissance assets, therefore they only generally met a division's needs. Not surprisingly, army and corps levels had a more favorable impression of aerial reconnaissance. In fairness, some of the corps and armies recognized the need to push control and coordination of tactical reconnaissance to lower levels. Concerning photo reconnaissance specifically, most units complained about time lags in receiving information. The Ninth Army admitted during a break-through of the Rhine River to the Elbe River, "Frequently we found the photographed area already in friendly hands by the time the prints were distributed."[9] Like their peers in Italy, most

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units in Europe praised the capability in planning future operations against fixed defenses, river crossings, and the Normandy landing, while others had negative impressions regardless of the situation. Universally, all units criticized the lack of night photo or tactical reconnaissance aircraft in sufficient numbers.[10]

Regarding tactical reconnaissance in France and Germany, the same ground units offered many similar conclusions as the Fifth Army. Where the terrain in these countries favored better maneuver warfare, tactical reconnaissance played a greater role in mobile situations after a break-through. That said, many units, especially divisions, criticized the distance from air bases to the front lines, frequently hundreds of miles, that reduced loiter over enemy territory and even caused units to sit on the ground in bad weather while the frontlines had clear skies. The 3d Armored Division's comment, "Recommend divisions be equipped and authorized to listen in on TACR [tactical reconnaissance] broadcasts while TACR missions are being flown," became a common theme among divisions.[11] Corps and divisions in general wanted more direct control and communication with reconnaissance units and pilots. In particular, they wanted near-real time voice reports of significant activity, and the ability to submit flash requests, what today is called dynamic retasking, to redirect the aircraft based on activity after the pilot took off.[12] Finally, divisions frequently found tactical reconnaissance reports vague and incomplete, significantly time delayed, or according to the 90th Infantry Division, "too long-ranged," suggesting a focus on corps and above taskings.[13]

In 1945, the United Stated Forces European Theater General Board gathered information from G-2 officers that concluded 58 percent of all combat intelligence gathered by the U.S. Army in France and Germany came from the military intelligence

specialist teams. Of the 58 percent, 43 percent came from interpreter and prisoner interrogation teams, while only 15 percent came from the photo interpreter teams. The remaining 42 percent came from various other sources. Moreover, board members concluded the figures were equally valid at the army, corps, and division levels. It remains unclear how the board derived these figures or whether actual data supported the claims, regardless the low figure is startling.[14] The report concluded two factors caused this situation, one the large numbers of prisoners and civilians available for interrogation, and two, the photo interpreters frequently faced issues beyond their control such as weather that stopped all work. That said, of all sources, the same G-2s concluded that photo intelligence provided the second best quantitative and qualitative source, despite its timeliness problems.[15]

These systemic issues between the European and Mediterranean theaters indicate deeper level problems existed within the Army Air Force aerial reconnaissance program. At its core, reconnaissance units maximized the available tools, technology, and organizational structure available for the period. The nature of the film development process coupled with the quantities required placed incredible demands on the reconnaissance units. Moreover, the daily interpretation of hundreds of square miles similarly induced additional hours into the process. When combined with an inadequate dissemination system, reconnaissance units could only achieve the timeliest results on a limited scale or in support of future planning. This breakdown occurred at the moment ground commanders needed it the most; when Fifth Army units broke through German defenses and the disposition changed significantly. Tactical reconnaissance partly filled

the void, but only on a limited basis. Collectively, these factors help explain the differing Army and Army Air Force perspectives on aerial reconnaissance in the Mediterranean.

Military history, while interesting for its own sake, is most useful when it provides instructive lessons for current operations. Today's Airmen rally around the doctrinal concept of "Centralized control, Decentralized execution." Yet even that statement does not fully describe the nature of air and ground operations in the current joint environment. The Joint Force Air Component Commander, known as the JFACC, directs joint air operations for the Joint Force Commander within a particular theater or area of operations. For the last several years in Iraq and Afghanistan, the JFACC has regularly given tactical control of Predator Unmanned Aerial Vehicles to ground commanders, usually at the brigade level. Based on priorities determined at the joint level between components and major units, this direct support can last many hours before tactical control shifts to other ground force commanders. Whereas in 1945 a division lacked the ability to communicate with tactical reconnaissance pilots flying overhead, fusion cells in brigade tactical operations centers in Iraq or Afghanistan can now communicate directly with Predator crews directing and exploiting missions from the United States. This is an important change in Air Force and JFACC support to ground units, and remarkably, it parallels many of the lessons learned by reconnaissance units working with Fifth Army from 1943 to 1945.

Lastly, the lessons from the Mediterranean and subsequent campaigns help to explain the Army's collective desire for its own aerial reconnaissance capabilities. Whether this is based on a real or perceived unresponsiveness from the Air Force or JFACC, such an action guarantees the Army direct control and ownership of organic

imagery reconnaissance capabilities. With the proliferation of unmanned vehicles, the is Army moving to build these platforms to replace the OV-1 Mohawk aircraft that retired in 1996, and to reduce dependence on the JFACC for this support. Having come full circle, this decision reflected Fifth Army's similar success in reducing the organizational levels between itself and aerial reconnaissance squadrons some sixty years earlier.

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[1]3rd Photo Group, iii.

[2]Ibid., preface.

[3]Ibid.

[4]Ibid.

[5]Ibid.

[6]Headquarters, 941st Engineer Aviation Topographic Battalion, *The Engineer Role in Photographic Intelligence* (1944), 11.

[7]3rd Photo Group, preface.

[8]Ibid., 9.

[9]War Department, *Answers to Questionnaire for Key Questions on 'The Effects of Strategic and Tactical Air Power on Military Operations ETO'* (War Department, 1945), 4.

[10]This source included a good cross sample of inputs form Third and Ninth Armies, and their supporting corps and divisions, to include infantry, armor and airborne divisions. Ibid., 116-129.

[11]Ibid., 122.

[12]Ibid., 116-129.

[13]Ibid., 128.

[14]The Assistant Chief of Staff, G-2, HQ European Theater of Operations, tasked all G-2s that employed the specialist teams to provide the following information: the approximate percentage of intelligence obtained from the teams and documents sections, evaluate the importance of those sources, qualifications required by the teams, participation of the teams in other than intelligence operations, and difficulties

encountered with using the teams and recommendations. Inputs were requested by June 5, 1945. Given the rather generic guidance, it is difficult to infer too much from the percentages. It is unclear whether the responses had real data to base their estimates on, or whether there were simply opinions. The General Board, United States Forces, European Theater, "Military Intelligence Service," Appendix 2.

[15]Ibid., 28-29.

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